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Comparison of Different Types of 3D Printing Technologies

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Abstract- 3D printing is a form of non-traditional machining. Also known as additive manufacturing, it is a method of creating an object by laying successive layers of material until the whole object is created. Unlike subtractive manufacturing processes which usually result in up to 80-90% of the material being wasted, there is seldom any wastage of material in 3D printing. The concept of 3D printing has been around for a long time and its technology has evolved over the years. Different 3D printers make use of different kinds of technologies, printing methods and also different kinds of materials. This paper gives a general introduction to the concept of 3D printing, the different types of printing technologies with their advantages, limitation and compares each of them to different criteria such as surface finish, dimensional accuracy, material used, post processing requirements etc.

Index Terms- Additive manufacturing, Non-traditional machining, 3D printing, 3D printers

I. INTRODUCTION

Traditional machining such as turning, milling, drilling and grilling has been around for many years and has helped human beings to build things. Although the technology for traditional machining has evolved in recent years, it has a number of limitations. With the introduction of non-traditional machining such as electric discharge machining or electric chemical machining, the manufacturing world has changed and at present nearly all industrial processes require computers and robot technology. These processes stated all involve removing material from a larger mass of block to get the required shape of the final product. There are constraints such as fixtures and assembly for many traditional designs and their production processes which are often expensive and add cost to the production process.

Compared to traditional machining, 3D printing is a process of creating objects directly by stacking layers of material on each other until the required product is obtained. The layers are stacked up in a variety of ways depending on the technology being used. This technology allows the design of complex components therefore avoiding assembly requirement at no additional cost. 3D printing being a tool-less process, significantly reduces the prohibitive costs and lead times. The printing process usually starts with the making of a 3D digital model. This model can be created using any 3D software programmes or by scanning the product using a 3D scanner [1]. The model is then layered into slices and is converted into a file which is understandable by the 3D printer. The material processed by the 3D printer is layered according to the design.

II. CURRENT 3D PRINTING TECHNOLOGIES

All 3D printers do not use the same technology. There are numerous means to print the layers so as to form the finish product. Some techniques liquefy the material or simply soften it to make the layers whereas others uses high powered UV laser to cure photo-reactive resin and “print” the object.

Some of the 3D printing technologies that are most broadly utilized these days are:

1) Stereolithography (SLA)
2) Fused deposition modelling (FDM)
3) Selective Laser Sintering (SLS)
4) Laminated object manufacturing (LOM)
5) Digital Light Processing (DLP)

As shown in Figure 1, the very first step to 3D print an object is to make a model of the object using CAD software [3]. The model describes the geometrical properties of the object. The CAD file is then converted to STL file format. This file format defines the external closed surfaces of the original CAD model. The STL file also includes the data for each single layer and can make
calculations for the layers. The STL file is sent to the 3D printer and the printer is setup before build process, where settings include build parameters, like energy source, layer thickness, etc. The part is then printed by an automated process without any supervision. When printing is done, the printed part is removed and sent for post processing. After that, the object is ready for application.

Since there are different 3D printing technologies, the type to be used depends mostly on the kind of object to be made. Each of them has its claimed benefits and downsides. The next section explains each of the different processes in detail and gives examples of products that can be produced by each of them.

A. Stereolithography
Stereolithography (SLA) is recognized as the original 3D printing process. SLA is used mostly to create models, prototypes and patterns. Being a laser based process; it uses ultraviolet laser and a vat of resin to build parts. The laser beam marks the design onto the surface of the liquid polymer. Exposure to the ultraviolet laser causes the chains of atoms in the polymer gum to connect together [4]. As the photopolymer resins react to the laser, it forms a solid part in a very precise way.

Figure 2: Stereolithography process
The Figure 2 shows the setup of SLA. The vat contains the polymer with a movable platform within. The laser beam is focused on the X-Y axis across the top surface of the resin according to the data input in the printer. The resin hardens precisely where the laser hits the surface. As one layer is finished, the platform in the vat is dropped by a little along the Z-axis and the next layer is then traced over the previous layer. This process goes on until the entire object is printed and the platform is elevated out of the vat for removal.

Figure 3: Objects produced by SLA

Stereolithography is most commonly used for prototyping as it is less time-consuming and it is relatively cheaper compared to other prototyping method. Nevertheless, the SLA process requires support structures for some parts mainly for those with overhangs [5]. These structures need to be manually detached during post processing. Post processes also include chemical bath to clean the object and subjecting the object in an oven-like machine to fully harden the resin.

SLA is one of the most accurate 3D printing processes with excellent surface finish and smoother surface than most other rapid prototyping methods. Smooth surface implies a great level of detail and the design is very accurate. Moreover parts can be printed in a very short period of time depending on its size and shape. Figure 3 show some parts printed using SLA. SLA also allows different options when it comes to material. Although SLA can produce a large variety of shapes, it is often very expensive.

B. Fused Deposition Modelling

Another technique of 3D printing technique is the Fused Deposition Modelling (FDM). This process is also used for making models as well as prototyping. 3D printers that run on this technology build a part layer by layer, from the bottom to the top by heating and extruding thermoplastic filament according to the 3D data supplied to the printer [6]. Each layer solidifies as it is put down and it bonds to the former layer.

Figure 4: Fused deposition process
FDM also works on the additive principle. The Figure 4 shows how a part can be produced using FDM. The heated extrusion head extrudes little dots of thermoplastic fabric to shape a layer. It can travel in the horizontal and vertical directions by a numerically controlled mechanism. The material hardens straightaway after coming out from the spout.

![Figure 5: Typical objects printed by FDM](image)

FDM is cheaper than SLA as it uses actual plastic instead of simulating plastic like material by projecting laser on resin. Similar to SLA, printing parts in FDM requires supports for complex structures. Therefore parts printed by FDM also require some post processing. But compared to SLA, FDM process is less accurate. The process can also be time consuming for some particular geometry. Moreover the material used in FDM is limited to thermos plastic. Figure 5 shows objects printed by FDM.

C. Selective Laser Sintering

Another technology used by today’s 3D printer is the Selective Laser Sintering (SLS). During this process, tiny particles of plastic, ceramics or glass are joined by heat from a high powered laser beam to form a solid.

![Figure 6: Basic setup of SLS](image)

As shown in Figure 6, the laser is traced across a powder bed according to the data file. The powder inside the powder bed is tightly compressed. The laser moves in the X and Y directions. The laser then hits the surface of the powdered material; it sinters the particles to each other to give form to a solid. When one layer is completed, the powder bed lowers in the Z direction and the levelling drum (roller) smoothes the powder over the surface of the bed. The laser then continues to trace and form the design required. The process repeats itself until the whole object is printed. The object is then left to be cooled down.
The build chamber needs to be completely sealed because it is necessary to maintain the temperature during the process to be the same as melting point of the powdered material. The powder bed is removed from the machine when the process is completed, and the excess powder is easily taken out of the printed object. The Figure 7 displays some parts which are 3D printed by SLS.

![Figure 7: Parts printed by SLS](image_url)

One of the major advantages of SLS is that it does not require any structure support for complex parts as needed in both Stereolithography and Fused Deposition Modelling. Because the part lies on a bed of powdered material, no supports are necessary. This advantage itself helps save material and reduces production cost. There is also no much need of post processing [7]. Moreover SLS is capable of printing geometries that cannot be done using other 3D printed method. Using SLS, parts with complex interior components can also be printed and there is no problem of removing supports and damaging the part. As a result, time is saved on assembly. Parts printed by SLS are usually very durable and robust. This technology now rivals those produced in traditional methods like injection moulding and are already used in many end-use application like automotive and aerospace.

Parts produced by SLS can be in different materials such as plastic, glass, and ceramics and with the advance in its technology it can also print metal. SLS is also widely utilized for printing tailor made products like hearing aids, dental retainers and prosthetics. Moreover objects printed with SLS don't necessitate any molds or additional tooling making it convenient for any user to print high complexity parts or particularly delicate object.

D. Laminated Object Manufacturing

In the method of Laminated Object Manufacturing (LOM), sheets of plastic or plastic materials are laminated or fused together by high temperature and pressure and then shaped to the required form with a computer controlled laser or blade [8].

![Figure 8: Laminated Object Manufacturing process](image_url)

As shown in the Figure 8, LOM 3D printer makes use of a continuous sheet of material which may be plastic or paper. A mechanism of feed roller spread the material along the build platform. The material is primarily coated with adhesive. When the laminating roller is heated and passed over the surface of the material, its adhesive melts and the roller press it onto the platform. A computer controlled laser or blade then cuts the material into the wanted form or pattern. Furthermore the laser removes any excess of material so that it is easier to remove the object when all the processes are completed.
After the first layer of the object is formed, the build platform then drops by a small amount. The second layer of material is then drawn across the platform and the heated roller passes over it, binding it to the one beneath. This procedure is performed repeatedly until the whole object has been formed. When printing is completed, the object is removed from the build platform. Excess materials are then cut away [9]. Afterwards some minor post processing is done. This may include sanding, painting or varnish to keep out moisture.

Figure 9: Prototypes printed by LOM

The cost for LOM is very low and the material is readily available. The printed parts have a similar look and feel of wood and can be worked with and finished in similar manner. The Figure 9 shows some prototypes that have been printed using LOM technology. Another advantage of Laminating Object Manufacturing is that it does not involve any chemical process or reaction and no enclosed chamber is needed. Therefore it makes it easier to build larger models. However this method is not ideal for making objects with complex geometries or to produce functional prototypes. For these reasons, LOM is only used to make scaled models and conceptual prototypes that can be tested for design or form.

E. Digital Light Processing

Another technology used by 3D printers is the Digital Light Processing (DLP). DLP is a similar process to Stereolithography. The main dissimilarity between these two methods is the light source. SLA uses a laser whereas DLP makes use of conventional light sources to cure photo sensitive polymer resin.

Figure 10 shows the process of DLP. DLP 3D printer prints objects by projecting them onto the surface of the resin. The exposed resin hardens and meanwhile the machine build platform lowers down to set stage for a new layer of fresh resin to be coated to the object and cured by light. The process is repeated until the 3D model is completed. Once completed, the model is sent for post processing to remove extra support structures and chemical bath for surface finish.

Figure 10: DLP Process
Like Stereolithography, DLP is also produces parts with high accuracy and high resolution. However one advantage that DLP has over SLA is that it requires a shallow vat of resin to facilitate the process. This generally results in less waste and lower running costs. Also DLP can be a faster process than SLA as the light source is applied to the whole surface of the vat of polymer resin at a single pass. DLP based printers makes use of photosensitive resin plastic which is suitable to make non-functional prototypes, highly detailed artworks, patterns for injection moulding, etc. Parts printed with this method have good strength properties. Figure 11 shows some prototypes that have been printed using DLP.

![Figure 11: Prototypes printed by DLP](image)

However the DLP services can be costly. And also, when the printing is completed, the object requires post processing to remove unnecessary support structure. Some photopolymer resins can be brittle depending on the object’s design but new improved resins are on their way to change this.

### III. COMPARISON OF 3D PRINTING TECHNOLOGIES

As mentioned in the previous section, not all 3D printers employ the same technique to print objects. While some make use of thermos-plastic filament, others use conventional light source or laser source to cure molecules in the polymer resin. There are different filament and resin to be used. Each of these technologies has their benefits and limitations. In this section, a comparison between these five different 3D printing methods mentioned above is given. The comparison is made upon a number of criteria like application, overall accuracy, materials options, finishing options and post-processing.

**Table I: Comparison of different types of 3D printing technologies**

<table>
<thead>
<tr>
<th></th>
<th>SLA</th>
<th>FDM</th>
<th>SLS</th>
<th>LOM</th>
<th>DLP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applications</strong></td>
<td>Excellent for form testing</td>
<td>Suitable for prototypes</td>
<td>Ideal for functional parts with various application</td>
<td>Ideal for non-functional prototypes</td>
<td>Similar to SLA</td>
</tr>
<tr>
<td></td>
<td>Best process for water resistant material</td>
<td>Home use applications</td>
<td>Suitable for complex shape object</td>
<td>Heat and chemical resistant</td>
<td></td>
</tr>
<tr>
<td><strong>Overall Accuracy</strong></td>
<td>Most accurate printing process</td>
<td>Accurate and reliable process</td>
<td>not very accurate</td>
<td>Slightly less dimensional accuracy</td>
<td>High Accuracy</td>
</tr>
</tbody>
</table>
Material Options | ABS | Semi-flexible materials | Thermoplastic materials | Nylon | Glass-Filled Nylon | Paper | Plastic | Metal | Similar to SLA |
---|---|---|---|---|---|---|---|---|---|
Finish Options | Excellent surface finish | Standard Finish | Standard Finish | Wood like characteristics and can be treated similarly | Good finish | High resolution |
Post Processing Requirement | Requires post processing to remove support structure | Requires post processing to remove support structure | Does not require support structure, less post processing requires | Polishing | Painting | Requires Post processing |

IV. DISCUSSION AND CONCLUSION

3D printing has revolutionized the way in which manufacturing is done. It improves the design manufacturing and reduces lead time and tooling cost for new products. As mention in the section above, there are several technologies used by 3D printers to build objects. The type of technology to be used depends mostly on the object to be manufactured. A comparison was carried out to show which method is the best fit for a particular job.

Stereolithography is the most popular 3D printing technology. It is widely used nowadays because it provides accuracy along with an excellent surface finish. It also allows printing of objects using a variety of materials. However it can be expensive and is used mostly by industries for making of prototypes. Digital Light Processing is quite similar to Stereolithography. The main difference between these two technologies is their type of light source.

Fused Deposition Modelling is a less expensive process compared to all other 3D printing method. This makes it suitable for home use application. The level of accuracy and surface finish it provides are worth the manufacturing cost. However, the materials that FDM supports are limited mostly to thermoplastics.

Selected Laser Sintering is a good choice for building objects with complex shapes and geometries. It does not require additional support like other 3D printing technologies and does not need much post processing. Nevertheless the final object might not be very accurate and the surface finish is not so good.

Laminated Object Manufacturing is an ideal choice for non-functional prototype. It does not provide good accuracy level and surface finish. It also requires much post processing. The material mostly used for this process is paper.

Even though these technologies are different in their own ways, they bring a host of benefits that conventional manufacturing simply cannot. They can allow customization of products according to the individual needs. They can also build complex products which cannot be produced physically in any other ways.

ACKNOWLEDGMENT

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[2] The free beginner’s guide to 3D printing
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Historical Overview of the Development of Communal Labor from Pre-colonial to Post Independent Ghana

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Abstract: Literature on communal work is very limited in Ghana, although the practice is found among many diverse cultures across the ten (10) regions of Ghana. This study takes up the challenge of presenting a short overview of the concept of communal labor from pre-colonial to post independent Ghana. The study is set to reveal indigenous institutions of communal labor and address the factors that have influenced the practice in each phase of Ghana’s development. Overall, the study is designed to enhance knowledge and understanding of the practice of communal labor in Ghana.

Index Terms: Communal, labor, culture, indigenous, institutions, pre-colonial, post-independent

Review of Relevant Literature on the concept of communal labor

Theoretically, communal labor is placed within the wider concept of community development. Jnanabrata Bhattacharyya (2004) has provided very useful theoretical insights into the theory of community development that will be useful in this study. According to him, community development is purposed to “building solidarity and agency through adherence to the principles of self-help, felt needs, and participation,” (Bhattacharyya 2004: 5). Drawing inferences from (Fried, 1971), he argued further that self help rests on a concept of human beings that when healthy they are willing and able to take care of themselves, to reciprocate, to be productive, more predisposed to give than receive, are active rather than passive, and creative rather than consuming, (Bhattacharyya 2004: 22). Felt needs in his view involve the development projects that respond to people’s needs as they see them; they should be demand-based, (Bhattacharyya 2004: 22). The principle of participation means inclusion, not merely in the electoral process or endorsing decisions but in deciding the agenda for debate and decision; it means inclusion in the processes of defining the problems to be solved and how to solve them, (Bhattacharyya 2004: 23). A similar view is expressed by Lee (2006) when he argued that “an understanding of and a commitment to empowerment and participation are at the core of community development,” (Lee 2006: 7). In applying this theory, Allison (2009) has observed that “the theory of Community Development is the most practical framework for social workers seeking lasting change for individuals and the communities and societies in which they live,” (Allison 2009).

Current study on community development fully recognizes the role of communities in addressing local challenges, ensuring efficiency in community projects and promoting meaningful local participation. (Tibabo and Nyaupane 2014; Winter 2006; Mannarini and Talò 2013). However, the key gap in research has been the need to recognize the different historical and contextual factors of communities, towns and villages in the promotion of community development.

In the case of Ghana, literature on communal labor and communal work in general is very limited, although the practice is widely recognized across different communities in Ghana. With the exception of (Lauren, 2010) who made quick reference to the practice when he addressed issues pertaining to colonial legacies in Africa, no comprehensive literature on communal labor exists in Ghana. On the entire African continent, references to communal labor can only be traced to Okia (2012) when he addressed the legitimization of coercion through communal labor in colonial Kenya. A quick review of literature reveals no comprehensive
account on communal labor in Ghana. This study is designed to address this academic gap by tracing the history of the practice in each phase of Ghana’s development.

**Historical overview of the concept of communal labor in Ghana**

The practice where community members come together to accomplish a particular task in the general interest of the community is an age-old phenomenon across many cultures around the world. In Ghana, communal work has been very instrumental to the country’s developmental process. The practice is traced to the pre-colonial, colonial and post-independent period.

Before the arrival of the Europeans in the Gold-Coast, the various ethnic groups and tribes in various towns and villages were governed under the authority of traditional chiefs popularly called *Omanhene* or *Odikro*. (Amoatia 2010). In the 1870s for instance, the political geography of Ghana was divided into local Kingdoms through dependent and independent chiefdoms. (Gareth 2007). The local chiefs during this era played significant roles in the governance of the communities. Inclusive of the legislative, executive and judicial powers possessed by the traditional chiefs, they were equally responsible for the total development of the communities. As a result, they mobilized their entire communities to perform communal duties for the common good of all.

The day set aside for communal work usually began with a dawn broadcast by a traditional public announcer, “gong gong beater” who under the authority of the chief summons all community members to communal duty. (Yankah 2016). Upon hearing the sound of traditional instruments such as double bell, “gong gong/dawuro” or “talking drums”, the entire community was obliged by custom and tradition to assemble at the chief’s palace, “Ahenfie” or the main village centre to carry out communal duties. The entire community freely and willingly cleared community fields, cleaned the environment, built bridges, weeded foot-paths, constructed public toilets, bore-holes and dealt with socio-cultural and economic issues that affected the general welfare of the community.

In the study of informal institutions and citizenship in rural Africa, MacLean (2010) recounts how in some Ghanaian villages the chief and local unit committee members organized themselves to aid government rural electrification project and provided labor for the construction of public school building and prepared for funerals in the villages. (MacLean 2010:211). Such gatherings were always climaxed by drumming and dancing, singing of traditional folk songs and people eating from the same bowl after a hard day’s work. The youth in particular, after communal duty will gather music instruments be it in the form of stones, sticks, cutlasses, drums et cetera, and make music to entertain themselves and the entire community. The Akans, for instance, formed their respective groups popularly called “Asafo” as a defensive force to repel all internal and external forces of the community. The Asafo group which was compulsory for all young men of the community was also used by the chiefs as important channel for community mobilization and development related activities. Some of the Asafo groups have survived the test of time and continue to play significant roles in traditional festivals among the Akans in Ghana. (Acquah *et al* 2014).

In the subsistence driven economy occupied by settler and peasant farmers (see Gareth 2010), the traditional chiefs in the pre-colonial era possessed enormous authority to summon all subjects to engage in communal work without much difficulty and hesitation. However, with the imposition of colonial rule in British West Africa and the introduction of the “indirect rule” system by the British colonial administration in the Gold-Coast, the legitimacy of the traditional chiefs was weakened. Olaoluwa (2006) in the study of chieftaincy in Ghana succinctly argues that “in some African societies, chieftaincy- the pre-colonial institution of governance with judicial, legislative and executive powers did not survive colonial and post colonial rule”. (Olaoluwa 2006:730).

In Ghana’s account, the Bond of 1844 in particular, marked the period in which official power was transferred from the traditional authorities especially the Fante and other local chiefs in the Gold-Coast to the British colonial administration. This treaty in particular legally obliged the local chiefs to transfer serious crimes committed by the local people to the British. (Miller *et al* 2009). Although, some traditional rulers were used to implement colonial policies and sustain British colonial dominance in the

era of indirect rule system, the chiefs had no longer absolute command to mobilize their subjects for communal duties. It is worthy of note that some of the traditional chiefs who became collaborators or intermediaries of the new colonial authority no longer served the interest of their local people. With their new role, the chiefs had to act in the interest of their new colonial masters. (Oquaye 2004).

According to Gareth (2010), colonial rule introduced a new semi-capitalist economy which was driven by settler plantation and peasant colonies. It is argued further that the introduction of this new economic model led to force recruitment of labor to work either for the state or for the newly established enterprises (Gareth 2010: 11-32). This account among other factors influenced the practice of communal labor under the new colonial authority and leadership. Unfortunately, this account of history remains unexplored in the academic discourse. The commitment by which the people of Gold Coast came together to contribute to the development of their communities and addressed emerging challenges was largely affected. New rules and regulations were established in the performance of communal work in the Gold-Coast. Broadly, it is observed that the change of authority changed the governance structure and this had some effects on traditional authority and the way communities were organized and governed. His Majesty Osagyefo Amoatia Ofori Panin (2010) observes that with the imposition of colonial rule, “the political governance of the nation-state transformed overnight from a familiar customary based one to a strange distant controlled one.” (Amoatia 2010: 3).

In the course of time, the people of Gold-Coast including the traditional chiefs developed general discontent and resistance to the colonial system of administration and asked for self-rule. (Howard 1999). The discontent spread across the country and this later became a nationwide struggle for freedom and independence. (Okyere 2000). The struggle for self rule sometimes led to violent conflicts between the local people on the one hand and the British colonial administrators on the other hand. (Sampson 2016; Konadu 2016; Gocking 2016). During the struggle for freedom and independence, the traditional chiefs and elders of the various ethnic groups and tribes played instrumental roles in the process. The local chiefs supported their political leaders and urged them to continue with the political struggle for self rule. (Howard 1999). A number of several ethnic based groups, some very violent in nature were formed to kick against the British rule. (Oquaye 2004). The ethnic based groups were later transformed into ethnic based political parties which later became a formidable force in the independence struggle. Finally, on the 6th March 1957, Ghana became the first country in Anglophone West Africa to gain independence from the British (Okyere 2000). On the 1st of July 1960, Ghana finally became a republican state which gave the country the right to elect its own head of state (Oquaye 2004). The transfer of political authority from the British to the people of Ghana was well celebrated by Ghanaian nationals and other countries across the world.

The state of communal labor in post-independent Ghana

Ghana became a constitutitional democracy at the time of independence but descended into authoritarianism in the 1960s (Boadi and Brobbey 2012). Ghana’s post-independence account is fully characterized by several coup attempts. In particular, the period of 1957 and 1981 were full of intense political competitions which were marked by several coup de tats interfering with civilian rule, (Ayensu and Darkwa 2006). Finally, in 1992 Ghana was ushered into the fourth republic with the establishment of the 1992 Republican Constitution1 and has since maintained democratic stability for the past twenty-four years. So far, the country has gone through six (6) successful and relatively peaceful elections. Ghana’s democratic rating has gone up among electoral observers across the world and has been touted as an established democratic example worthy of emulation in Africa. However, Ghana’s democratic stability has not come without numerous socio-economic challenges which have broadly been blamed on bad governance.

1 The 1992 Constitution of the Republic of Ghana
During the pre-colonial and colonial era, communal labor played an integral role in supporting the rural and colonial economies of Ghana. After Ghana gained independence on the 6th of March 1957, very little is said about the practice. Even in the era of sustainable development, not much has been discussed about the relevance of communal work in Ghana. Mobilizing people for communal work has become a challenging exercise. There is general apathy among Ghanaians in the performance of communal duties in both rural and urban communities. Attendance has been generally poor and unfortunately able-bodied young men and women stand aloof, leaving few elderly men to carry out communal duties in the various rural and urban communities. Also, the few community residents who attend communal labor are not well organized and coordinated. In most cases, participants do not know the specific duties they are required to perform during communal exercises. In the post-independence era, very little is known about the institutions that are responsible for mobilizing people for communal work. According to the Local Government Act 1993 (Act 462) and the Local Government Service Act, 2003, Act 656, the district assemblies are required to collaborate with the various associations, organizations and individuals at the local level in planning, coordinating and implementing development programmes at the community level. Further, it is observed that the new Local Governance Act, 2016, Act 936 makes similar assertion by calling on local districts to collaborate closely with community stakeholders to ensure the execution of local development projects. Unfortunately, these calls have not been given the necessary attention it deserves by both district authorities and community members due to growing community apathy. In fact, the legitimacy as well as the capacity of the district assemblies to mobilize people and coordinate communal labor activities in the communities remain unknown and unaddressed.

Additionally, national development policy framework has not adequately recognized the relevance of communal work to the development of Ghana and therefore the practice seems to be gradually dying off in the Ghanaian society. The National Sanitation Day\(^2\) which is an initiative by the Government of Ghana to mobilize community members to clean communities from filth is faced with many challenges especially in the area of community participation. Another prevailing challenge is the lack of clarity in the performance of communal work. In some instances, community residents who attend communal labor are left to decide on their own the specific task they are assigned to perform. Further, there seem to be no ramification for community residents who fail to perform communal duties in Ghana. This study is of the view that lack of scientific approach to find out from community residents themselves on the factors that have accounted for the present state of communal labor remain a challenge and should be addressed.

In this brief account of history, communal labor which has been a long term sustainable development practice in Ghana has no comprehensive written account in academic discourse. The lack of comprehensive literature to explain the relevance of communal labor to national development has equally not contributed to the development of this field and therefore has denied Ghana from obtaining the needed benefits from the practice. The study is set to address these challenges by providing comprehensive literature on communal labor from pre-colonial to post independent period.

**Conclusion**

The practice of communal labor has been very instrumental to the country’s developmental process. Unfortunately, national development policy framework has not adequately recognized and captured the relevance of communal work to the development of Ghana and therefore the practice seems to gradually dying off in the Ghanaian society. In the era of sustainable development, there is no better way to sustain national development than the practice of communal labor. It is recommended that the Government of Ghana integrates this practice into the country’s national development policy framework to inspire its young population to contribute to national development.

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Moisture characteristics of soils of different land use systems in Ubakala Umuahia, Abia State, Nigeria.

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Abstract: Information about effects of different land use systems on soil moisture characteristics is crucial for efficient land management practices. This study was, therefore, conducted to evaluate the variations of soil moisture characteristics under different land use systems in Ubakala, Umuahia South Local Government Area, Abia State, Nigeria. The land use systems studied included cassava-cultivated land (CC), 4-year bush fallow land (4-BF) and forest land (FL). The research was superimposed on land use systems that were located nearby on soil with similar parent material. Undisturbed core and disturbed auger soil samples were randomly collected from three sampling points with three replications for each land use system at two varying depths (0-20 cm and 20-40 cm). The undisturbed core samples were analysed for soil moisture characteristics in the laboratory except infiltration rate which was determined in the field with the use of double ring infiltrometer. The auger samples were analyzed for particle size distribution. Data generated were subjected to analysis of variance (ANOVA) for randomized complete block design (RCBD). Results indicated that the CC was sandy clay loam in texture while the 4-BF and FL were sandy loam textured. At both depths, CC retained the lowest amount of moisture at field capacity (0.188 and 0.199 m³/m³), permanent wilting point (0.100 m³/m³) and available moisture content (0.088 and 0.099 m³/m³). In contrast, the highest amount of moisture retained at field capacity (0.214 and 0.217 m³/m³) and permanent wilting point (0.109 and 0.103 m³/m³) was found under the FL at both depths. However, the 4-BF recorded the highest available moisture content at 0 – 20 cm depth (0.106 m³/m³) while FL had the highest at 20 – 40 cm depth (0.114 m³/m³). The slowest saturated hydraulic conductivity (Ksat) (0.71 and 0.62 cm min⁻¹) at both depths and infiltration rate (Ir) at 0 – 20 cm (0.63 cm min⁻¹) were recorded under CC whereas the fastest Ksat (0.80 and 0.77 cm min⁻¹) was found under 4-BF. Forest land had the fastest Ir (0.73 cm min⁻¹). In all land use systems, field capacity and available moisture content increased with soil depth while permanent wilting point decreased. Conversion of bush fallow and forest lands to arable farm lands will affect the soil moisture retention and transmission characteristics. It is therefore recommended that appropriate and integrated land management options for different land use systems are undertaken to sustain agricultural productivity while protecting the environment.

Keywords: land use, moisture retention, moisture conduction, ANOVA, Ubakala

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Introduction

Land use system is a complex process shaped by human activity, affected by ecological, economic, and social drivers, and capable of influencing a wide range of environmental and economic conditions (MacDonald et al., 2000). Changes in land use affect physical, chemical and biological characteristics of the soil (Shukla et al., 2003). Soil moisture characteristics, which are important soil hydrological properties, are affected by soil structure, aggregate stability, particle size distribution, land use system (Fu et al., 2000), vegetation (including plant and litter cover and type, and soil organic content), topography and climate (Jimenez et al., 2006). Increase in ground cover often results in increase in soil infiltration rate and saturated hydraulic conductivity (Shukla et al., 2003). Land use change from natural or semi-natural vegetation to continual tillage and grazing has a marked effect on soil bulk density, porosity, aeration, infiltration, water storage, water transport and runoff (Broersma et al., 1995).

Land use and soil management practices influence the soil organic matter and related soil processes, such as moisture transmission (Liu et al., 2010). As a result, it can modify the processes of soil water transport and re-distribution of nutrients. Some land use systems include continuous cropping, forestland and bush fallowing (Agoume and Birang, 2009). Forest land use system has caused positive modifications in the soil physical properties (Shepherd et al., 2000) and resulted to the development of tree biomass (Versterdal et al., 2002). The conversion of forest and pasture lands into crop land is known to deteriorate soil properties, reduce the soil water transmission, change the distribution and stability of soil aggregates (Singh and Singh, 1996) and soils may become more susceptible to erosion since macro aggregates are disrupted (Six et al., 2000). Continuous cropping decreases moisture conducting characteristics of soils while increasing the depletion of organic matter (Celik, 2005). Bush fallowing can alter soil moisture characteristics through the amounts of organic residues that are returned (Neris et al., 2012). Usually, the larger the amount of residues returned over a period of several years, the higher the level of organic matter which increases the volume of water transmitted in the soil (Malgwai and Abu, 2011).
Changes in soil properties attributed to changes in land use systems are difficult to estimate due to the time scale of the changes (Garcia-Estrinaga et al., 2012). It is also difficult to distinguish land use induced changes from changes caused by other effects such as changes in climate (Hu et al., 2009). However, the effect of climate manifests on a much longer time scale compared to that of land use change (Novak et al., 2009). Soil moisture characteristics are influenced by the type of the cultivated plants, the seasonal impact, and land use systems such as altered agricultural systems (Zhou et al., 2008).

The evolution of different soil hydrological properties in natural ecosystems, such as forests, can be a relatively slow process. However, in agricultural land use systems, mechanical disturbances, like tillage systems, can rapidly change the soil moisture characteristics (Lipiec et al., 2006). Water and nutrients are essential for plant growth and soil health. Therefore, it is important to know the effects of various land use systems on soil moisture characteristics and nutrient transport within the soil matrix. The objective of this study was to determine the effects of land use systems on soil moisture characteristics.

Materials and method

Study area.

The study was carried out in Ubakala in Umuahia South Local Government Area of Abia State, South eastern Nigeria. The area is located within latitude 5°30′N and longitude 7°28′E (NRCRI, 2007). It is highly populated, with an average population density of 2600 inhabitants per square kilometre (Ukandu et al., 2011). The location has a mean annual rainfall of 2201.92mm (NRCRI, 2007). The rainfall is bimodal, starting in April and ending in October with peaks in June and September.

Within the location, cassava-cultivated land, forest land and 4-year bush fallow land were investigated. These sites are within Ubakala metropolis. The forest land had existed for over 60 years with trees such as Milica excels (iroko), Swieteria mahgani and Gamelina arborea (gmelina) while the 4-year bush fallow land had trees such as Dialium guineese, Chromolaena odorata (siam weed), Anthronotha macrophylla and Parinari congensis. The cassava-cultivated land had been under continuous cultivation of cassava crop.

Soil Sampling

Under each land use system, 3 sampling points were located randomly. Around each of the 3 sampling points within a land use, soil samples were collected at 2 depths (0 – 20 and 20 – 40 cm) using soil auger. This constituted a total of 6 samples for each land use and a grand total of 18 bulk samples for the 3 land use systems. Two core samples were collected, one at 0 – 20 cm and the other at 20 – 40cm from each of the 3 sampling points making a total of 6 core samples in each land use system. Also, a total of 18 core samples were collected for analysis.

Sample Preparation

The soil samples collected with the soil auger were air-dried and sieved through 2mm sieve size for particle size analysis. The base of each core sample was covered with a cheese cloth and saturated in water for determination of soil physical properties.

Laboratory Analysis

Particle size distribution analysis was by the Bouyoucos hydrometer method as outlined by Kettler et al., (2001).

Field capacity and permanent wilting point were determined using the estimation method described by Mbagwu (1991).

Available water content (AWC) was deduced from field capacity (FC) and permanent wilting point (PWP) thus:

\[
AWC = FC - PWP
\]  

Saturated hydraulic conductivity (Ksat) was determined by the constant head method (Stolte, 1997).

Infiltration rate (Ir) was determined at the sites using double ring infiltrometer as described by Ayu (2013).

Statistical Analysis

Analysis of variance (ANOVA) for randomized complete block design (RCBD) was used to compare the influence of land use system and depth on soil physical properties. Significantly different means were separated using least significant difference at 5% level of probability (P≤0.05).
Results and Discussion

Particle size distribution: The particle size distribution of the soils studied is shown in Table 1. At both depths of 0 – 20 and 20 – 40 cm, the texture of soil under cassava-cultivated land (CC) was sandy clay loam while 4-year bush fallow and forest lands were sandy loam at both depths.

At the depths of 0 – 20 and 20 – 40 cm, respectively, the highest sand contents of 724.0 and 708.0 g/kg were observed under the 4-year bush fallow land (4-BF). Cassava-cultivated land (CC) recorded the lowest at both depths (705.0 and 685.2 g/kg). With regard to silt contents, the 4-year bush fallow land (4-BF) recorded the highest at the two depths (119.0 and 112.0 g/kg). The lowest silt and highest clay contents were observed under cassava-cultivated land at both depths. The values ranged from 61.0 to 67.8 g/kg for silt and 234.0 to 247.0 g/kg for clay. The lowest clay contents at both depths were observed in the 4-year bush fallow land (64.0 and 83.0 g/kg).

Generally, the sand and silt contents decreased with depth while the clay contents increased. However, the silt content under cassava-cultivated land increased with depth. As shown in Table 1, and with regards to depth, sand and clay particles were significantly (P≤0.05) different, whereas silt was statistically similar. With regards to the land use systems and depths, the sand, silt and clay particles of cassava-cultivated land (CC) were significantly (P≤0.05) different from 4-BF and FL. The land use systems differed significantly in their particle size distribution. However, sand fraction of the 4-BF was statistically similar to that of FL at both depths.

### Table 1: Particle size distribution of soils studied

<table>
<thead>
<tr>
<th>Land use</th>
<th>Soil Properties</th>
<th>Sand (g/kg)</th>
<th>Silt (g/kg)</th>
<th>Clay (g/kg)</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 20 cm</td>
<td>CC</td>
<td>705.0</td>
<td>61.0</td>
<td>234.0</td>
<td>sandy clay loam</td>
</tr>
<tr>
<td></td>
<td>4-BF</td>
<td>724.0</td>
<td>119.0</td>
<td>157.0</td>
<td>sandy loam</td>
</tr>
<tr>
<td></td>
<td>FL</td>
<td>713.3</td>
<td>106.7</td>
<td>180.0</td>
<td>sandy loam</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>714.1</td>
<td>95.6</td>
<td>190.3</td>
<td></td>
</tr>
<tr>
<td>20 – 40 cm</td>
<td>CC</td>
<td>685.2</td>
<td>67.8</td>
<td>247.0</td>
<td>sandy clay loam</td>
</tr>
<tr>
<td></td>
<td>4-BF</td>
<td>708.0</td>
<td>112.0</td>
<td>180.0</td>
<td>sandy loam</td>
</tr>
<tr>
<td></td>
<td>FL</td>
<td>703.2</td>
<td>101.3</td>
<td>195.5</td>
<td>sandy loam</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>698.8</td>
<td>93.7</td>
<td>207.5</td>
<td></td>
</tr>
</tbody>
</table>

LSD0.05

- **Land use**: 10.0 19.3 11.0
- **Depth**: 2.1 17.9 10.2
- **L x D**: 10.4 15.9 8.1

**CC** = cassava cultivated land, **4-BF** = 4-year bush fallow land, **FL** = forest land

L x D = Interaction of land use x depth.

The high sand contents of the soils could be attributed to their being derived from unconsolidated sand deposits formed over coastal plain sand (Asawalam et al., 2009; Chukwu, 2013). The removal of vegetative cover and top soil as a result of intensive cultivation exposed the soil thereby contributing to the high sand and clay contents giving rise to its sandy clay loam texture (Jaiyeoba, 2003). The sandy loam texture observed in the 4-year bush fallow and forest lands corroborated the report of Ufot et al. (2016), who reported sandy loam texture for bush fallow and forest lands in Akokwa, Imo State. The higher clay contents observed at the subsoil under cassava-cultivated land could be attributed to increased cultivation (Oguike and Onwuka, 2017). This may be as a result of either increase of clay translocation from the surface to subsurface horizons or removal of clay from the surface by runoff (Jaiyeoba, 2003). On the contrary, Shepherd et al. (2000) observed that changes due to land use do not show easily for particle size. The increase in clay with soil depth may be due to dissolution and leaching of clay materials as a result of intense torrential rainfall (Oguike and Onwuka, 2017), argillation of clay, lessivage and sorting of soil materials (Ojanuga, 2003).

Moisture retention characteristics.

Soil moisture characteristics such as field capacity (FC), permanent wilting point (PWP) and available water content (AWC) of soil studied are shown in Table 2. Among the parameters measured at the two depths (0 – 20 and 20 – 40 cm), forest land (FL) contained the most moisture at field capacity with values 0.214 and 0.217 m³/m³. The cassava-cultivated land (CC) was observed to contain the lowest (0.188 and 0.199 m³/m³) at both depths. With regard to permanent wilting point (PWP), forest land (FL) contained the most at both depths with values of 0.109 and 0.103 m³/m³, while cassava-cultivated land contained the lowest (0.100 m³/m³) at both depths. 4-year bush fallow land (4-BF) had the highest available water content (0.106 m³/m³) at 0 – 20 cm.
depth while forest land recorded the highest (0.114 m³/m³) at 20 – 40 cm. However, cassava-cultivated land had the lowest with values 0.088 and 0.099 m³/m³ at 0 – 20 and 20 – 40 cm depths, respectively.

<table>
<thead>
<tr>
<th>Land use</th>
<th>Soil Properties</th>
<th>FC (m³/m³)</th>
<th>PWP (m³/m³)</th>
<th>AWC (m³/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 – 20 cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>0.188</td>
<td>0.100</td>
<td>0.088</td>
<td></td>
</tr>
<tr>
<td>4-BF</td>
<td>0.211</td>
<td>0.105</td>
<td>0.106</td>
<td></td>
</tr>
<tr>
<td>FL</td>
<td>0.214</td>
<td>0.109</td>
<td>0.105</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.204</td>
<td>0.105</td>
<td>0.100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 – 40 cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>0.199</td>
<td>0.100</td>
<td>0.099</td>
<td></td>
</tr>
<tr>
<td>4-BF</td>
<td>0.214</td>
<td>0.101</td>
<td>0.113</td>
<td></td>
</tr>
<tr>
<td>FL</td>
<td>0.217</td>
<td>0.103</td>
<td>0.114</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.210</td>
<td>0.101</td>
<td>0.108</td>
<td></td>
</tr>
<tr>
<td>LSD₀₅₀₅</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land use</td>
<td>0.012</td>
<td>0.028</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>Depth</td>
<td>0.069</td>
<td>0.024</td>
<td>0.040</td>
<td></td>
</tr>
<tr>
<td>L × D</td>
<td>0.010</td>
<td>0.031</td>
<td>0.037</td>
<td></td>
</tr>
</tbody>
</table>

CC = cassava-cultivated land, 4-BF = 4-year bush fallow land, FL = forest land, L × D = Interaction of land use × depth.

Generally field capacity and available water content increased with depth, while permanent wilting point decreased with depth. As shown in Table 2 and with regards to land use systems, at both depths, the field capacity of CC was significantly (P≤0.05) lower than 4-BF and FL. Also at both depths, the field capacity of 4-BF was significantly (P≤0.05) similar to FL. Forest land was significantly (P≤0.05) higher in permanent wilting point than the other land use systems, while CC was significantly (P≤0.05) lower. Cassava-cultivated land had significantly (P≤0.05) lower available water contents than 4-BF and FL at both depths.

The high field capacities recorded under 4-year bush fallow land and forest land may be attributed to the high organic matter which provided large surface area required for the absorption and retention of water molecules (Materechera and Mkhabela, 2001). The high water retention capacity of soils under 4-year bush fallow and forest lands was similar to the findings of Ayoubi et al. (2011). The low available water content of soils under cassava-cultivated land may be attributed to their low structural stability. Yihenew and Ayanna (2013) who made similar observation reported that land under continuous cultivation deteriorated soil structural aggregates, reducing their available water contents.

Moisture transmission characteristics.

The moisture transmission characteristics of the soils studied are shown in Table 3. At the depths of 0 – 20 and 20 – 40 cm, 4-BF had the fastest Ksat of 0.77 and 0.80 cm min⁻¹, respectively, while CC had the slowest of 0.62 and 0.71 cm min⁻¹, respectively. The Ksat under CC was significantly (P≤0.05) slower than 4-BF and FL at both depths whereas 4-BF and FL were statistically similar. For the infiltration rates (measured only at 0 – 20 cm), FL was the fastest among the three land use systems. The difference in infiltration between FL and 4-BF was not significant but they significantly (P≤0.05) differed from CC.
Table 3: Moisture transmission characteristics of soils studied

<table>
<thead>
<tr>
<th>Land use</th>
<th>Soil Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>K_sat (cm min⁻¹)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 20 cm</td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>0.71</td>
</tr>
<tr>
<td>4-BF</td>
<td>0.80</td>
</tr>
<tr>
<td>FL</td>
<td>0.78</td>
</tr>
<tr>
<td>Mean</td>
<td>0.76</td>
</tr>
<tr>
<td>20 – 40 cm</td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>0.62</td>
</tr>
<tr>
<td>4-BF</td>
<td>0.77</td>
</tr>
<tr>
<td>FL</td>
<td>0.74</td>
</tr>
<tr>
<td>Mean</td>
<td>0.71</td>
</tr>
<tr>
<td>LSD₀.₀₅</td>
<td></td>
</tr>
<tr>
<td>Land use</td>
<td>0.06</td>
</tr>
<tr>
<td>Depth</td>
<td>0.02</td>
</tr>
<tr>
<td>L × D</td>
<td>0.42</td>
</tr>
</tbody>
</table>

CC = cassava-cultivated land, 4-BF = 4-year bush fallow land
FL = forest land
L × D = Interaction of land use × depth

The slow saturated hydraulic conductivity and infiltration rate observed under CC may be attributed to structural instability and possible compaction due to mechanical disruption of the pore arrangements resulting from frequent tillage (Celik, 2005). The fast saturated hydraulic conductivity and infiltration rate observed under 4-BF and FL may be as a result of high organic matter content expected in soils under such land use systems. This concurred with the findings of Malgwi and Abu (2011) who reported that the high level of organic matter in forest and bush fallow lands led to low bulk density, high total volume and favoured transmission of water under saturated conditions.

Conclusion and Recommendation

The objective of this study was to compare the impact of land use systems on soil moisture characteristics. From the study, it may be concluded that soil moisture characteristics significantly vary among land use systems. It may also be apparent that change in land use systems from natural forest and bush fallow lands to continuous arable cropping will have a significant effect on soil moisture characteristics. It is recommended that various integrated land management such as replenishing either by using crop residues as mulching or applying such inputs as organic wastes/materials to enhance the organic matter status of cassava cultivated land should be practiced to overcome land degradation and achieve sustainable agricultural production in cultivated lands of the study area.

References


Analysis of Student Inhibiting Factors Initiating Entrepreneurship

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Abstract- This study aims to determine and classify the barriers experienced by students to start entrepreneurship. This type of research is exploratory. The sampling technique used proportionate stratified random sampling with a total sample of 262 people. The Data analysis technique used is Factor Analysis. The collected data is processed statistically using SPSS version 24.0. The result of the research shows that there are seven new factors that can hamper the students to start the business, first the basic ability of entrepreneurship, the two factors of striving, the three factors of future uncertainty, the four factors of courage, the five resource factors, the six risk factors, the seven information factors.

Index Terms- Inhibiting Factors, start-up business, entrepreneurship

I. INTRODUCTION

BPS data in 2017 describes total unemployment in Indonesia reached 7,005,262 people (5.3%) which increased from the previous year. The increase in the number of unemployed is caused by the lack of employment while the number of college graduates continues to grow. As a result, there is an imbalance between the number of employment and the labor force. This is seen from the phenomenon of the enlarged registrants when the government opens the Candidate for Civil Servants (CPNS) in 2017. Based on data from BKN, total applicants reached 2,433,656 people for 37,138 formation. This problem can trigger the poverty rate in Indonesia is getting worse. Therefore, the role of individuals, communities and governments is needed to reduce the number of unemployed in Indonesia.

One alternative to reduce unemployment rate is with entrepreneurship activity [1], [2]. Some studies show that entrepreneurial activity has a positive impact on economic activity [3]–[14]. Entrepreneurship establishes social relationships through working relationships and business relationships between individuals / communities [6], improves the quality of human resources [7], enhances competitiveness and contributes to economic growth [9], and can improve the economy for the realization of prosperity and prosperity of the people [15].

Padang State University (UNP) as one of the educational institutions in Indonesia has a focus on giving birth to professional and capable graduates in entrepreneurship. This effort is manifested with the entrepreneurship subject as compulsory subject in Faculty of Economics. In general, UNP students who have attended entrepreneurship courses are known as 8.3% of people who own businesses, 41.7% have plans to start businesses, 20% are not interested in becoming entrepreneurs, and 30% of people are interested in working with agencies government and SOEs. Students interested in entrepreneurship support the government to reduce the number of unemployed [19]. Meanwhile, students who are not interested in entrepreneurship are associated with several issues, such as capital problems due to insufficient financial resources, ideas that make it difficult to start, a less supportive environment, lack of experience, lack of information, lack of knowledge, lack of skills, and fear the risks [2], [17], [22].

PMW (Student Entrepreneurial Program) is one of the government's efforts to encourage students to entrepreneurship. This program involves students directly to start their desired business units through the selection, supervision and evaluation of business companions [2]. The goal of the Entrepreneurial Student Program (PMW) is to produce innovative Entrepreneurs in the future and to promote the Indonesian economy [20]. In addition, the program is useful for students to work for themselves and do not need to look for job vacancies either held by the private sector or government which is very limited [19], [22]. Meanwhile, if college graduates
want to work in a place that is in accordance with the discipline of science, entrepreneurship is owned is considered sufficient to be a stock when plunging into the community, so that the student as a development agency for the community [23].

Theoretically, the existence of learning and practice on entrepreneurship courses as well as government support can encourage students to start a business early on. However, the reality is not in line with the theory. Until now, students who entrepreneurship individually or through the program still PMW slightly especially among students of the Faculty of Economics, State University of Padang (FE UNP). This can be seen based on the data in Table 1 below:

### Table 1. Number of UNP Students Proposing PMW Proposals

<table>
<thead>
<tr>
<th>No.</th>
<th>Years</th>
<th>FACULTY</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>FIP</td>
<td>FBS</td>
</tr>
<tr>
<td>1</td>
<td>2014</td>
<td>41</td>
<td>51</td>
</tr>
<tr>
<td>2</td>
<td>2015</td>
<td>84</td>
<td>83</td>
</tr>
<tr>
<td>3</td>
<td>2016</td>
<td>38</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>2017</td>
<td>17</td>
<td>51</td>
</tr>
</tbody>
</table>

**Source:** BAK State University of Padang 2017

The number of students who join the PMW (Table 1) tends to fluctuate each year. This study assumes that the phenomenon of at least entrepreneurial students is related to factors that hinder or facilitate students in starting entrepreneurship. In general, the inhibiting factors come from internal and external individuals. Internal inhibiting factors are concerned with the individual [2], [4], [6], [12], [13], [18], [24]–[26], such as intentions and experiences [6]. External inhibiting factors are formed or influenced by the circumstances surrounding the individual [9]–[11], [13], [19], [23], [24], [27]–[32], such as environment and family support [29]. Therefore, this study would like to know more about the factors that hamper students to start entrepreneurial activities [10], [32].

Furthermore, this study has the following objectives. First, examine the concept of entrepreneurship in addition and develop more complex science. Second, to know the challenges experienced by students to start entrepreneurship. In particular, the purpose of this study is to clarify and classify the barriers that students experience to start entrepreneurship by factor analysis.

The next discussion of this study is structured as follows. Part 2 examines the latest literature on entrepreneurship. Section 3 discusses the methods used to analyze data. Section 4 presents the results of research briefly. Section 5 is the conclusions.

## II. LITERATURE REVIEW

Qualified human resources (HR) creates creative and innovative entrepreneurs [12]. Intention and courage are the initial capital to become an entrepreneur [24]. Entrepreneurial activity is an opportunity to determine fate because it gives freedom for entrepreneurs to achieve what is important to him [30]. Opportunities for change, opportunities to increase self-potential, and opportunities for self-actualization to achieve stunning benefits [23], [31], many entrepreneurs are not super rich, but many of them are prosperous [8].

Most entrepreneurs have interesting characteristics. First, have high confidence they dare to take risks to make success as a necessity [20], [23]. Second, they have a sense of responsibility, ambitious, committed, tolerant, flexible, focused, skilled, highly motivated, achievers, future-oriented in finding opportunities, not easily satisfied and never give up [3], [4]. Third, they have as a vast business network, consisting of: networking, friends, and cooperative relationships [12], [22], [32]. Fourth, they are responsive and creative to change, consisting of: critical thinking, fun, proactive, creative, innovative, efficient, productive, original, and maintains their quality [16], [21], [32], [33].

Although it has interesting characteristics, but still there are some challenges faced by students in starting a business. The barriers are difficulties, obstacles and problems faced by entrepreneurs in starting a business [19]. In particular, these barriers consist of income uncertainty, the risk of losing all investment, low quality of life, higher levels of stress, full responsibility, temporary employment, long and unclear working hours, less encouraging education systems, perceptions about failure, wrong myths about entrepreneurship, not knowing how to get started, no experience, no capital, no courage, no guiding person, fear of getting out of comfort zone, needing big capital, being less independent, afraid of risk, lack of start-up information, lack of information on sources of capital, lack of skills, lack of knowledge, lack of ideas, unsupportive environments [4]–[8], [10], [12], [17], [18], [22], [23], [25], [27], [29], [34], [35].

## III. METHOD

This study was conducted at UNP, the population focused on the Faculty of Economics, State University of Padang (FE UNP), which consists of 6 courses (Diploma III - Bachelor) with the number of 753 students. Sampling technique used the proportionate stratified random sampling in Sample as many as 262 students consisting of Accounting study program (D3) as many as 31 students, Trade Management (D3) as many as 29 students, Accounting (S1) as many as 48 students, Economic Education (S1) as many as 46 students, Management (S1) as many as 66 students, Economics (S1) as many as 41 students.

Questionnaires are based on the environmental phenomena and literature review focusing on student barriers start entrepreneurship. Fill out the questionnaire through physical (direct) and through google form (indirect). Each answer to item
statement uses the interval scale (1) - (5). Factor analysis classifies the variables into several inhibiting factors with using SPSS 24.0 program.

IV. RESULT
Based on the main objective of this study to see what factors are hindering students starting entrepreneurship that can be grouped into several factors. Data processing factor analysis using the help of SPSS 24.0. The output of KMO Measure of Sampling Adequacy (MSA) is 0.773. The value is 0.773 > 0.5 with sig value. 0.000 which means the sample and correlation between variables is feasible for further process.

Table 2. Sufficiency of sample

<table>
<thead>
<tr>
<th>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</th>
<th>.773</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartlett's Test of Sphericity</td>
<td></td>
</tr>
<tr>
<td>Approx. Chi-Square</td>
<td>3805.822</td>
</tr>
<tr>
<td>Df</td>
<td>300</td>
</tr>
<tr>
<td>Sig.</td>
<td>.000</td>
</tr>
</tbody>
</table>

The next process looks at the magnitude of an MSA variable with an anti-image matrices. Variable 1 (0.599), Variable 2 (0.628), Variable 3 (0.747), Variable 4 (0.585), Variable 5 (0.880), Variable 6 (0.751), Variable 7 (0.622), Variable 8 (0.616), Variable 9 (0.764), Variable 10 (0.701), Variable 11 (0.853), Variable 12 (0.789), Variable 13 (0.739), Variable 14 (0.907), Variable 15 (0.748), Variable 16 (0.753), Variable 17 (0.543), Variable 18 (0.791), Variable 19 (0.865), Variable 20 (0.816), Variable 21 (0.579), Variable 22 (0.733), Variable 23 (0.805), Variable 24 (0.883), Variable 25 (0.826). Each variable has MSA value > 0.5 then all variables can be processed further.

The value of the variables in Communalities indicates the magnitude or the variance of each variable explained by the factor formed. The total variance explained shows the factor formed from 25 variables.

Table 3. Establishment of entrepreneurial inhibiting factors

<table>
<thead>
<tr>
<th>Component</th>
<th>Initial Eigenvalues</th>
<th>Extraction Sums of Squared Loadings</th>
<th>Rotation Sums of Squared Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>% of Variance</td>
<td>Cumulative %</td>
</tr>
<tr>
<td>1</td>
<td>7.421</td>
<td>29.683</td>
<td>29.683%</td>
</tr>
<tr>
<td>2</td>
<td>3.250</td>
<td>13.000</td>
<td>42.682%</td>
</tr>
<tr>
<td>3</td>
<td>1.756</td>
<td>7.024</td>
<td>49.706%</td>
</tr>
<tr>
<td>4</td>
<td>1.669</td>
<td>6.675</td>
<td>56.381%</td>
</tr>
<tr>
<td>5</td>
<td>1.342</td>
<td>5.366</td>
<td>61.747%</td>
</tr>
<tr>
<td>6</td>
<td>1.190</td>
<td>4.760</td>
<td>66.508%</td>
</tr>
<tr>
<td>7</td>
<td>1.021</td>
<td>4.084</td>
<td>70.592%</td>
</tr>
<tr>
<td>8</td>
<td>.874</td>
<td>3.496</td>
<td>74.087%</td>
</tr>
<tr>
<td>9</td>
<td>.809</td>
<td>3.236</td>
<td>77.324%</td>
</tr>
<tr>
<td>10</td>
<td>.807</td>
<td>3.227</td>
<td>80.551%</td>
</tr>
<tr>
<td>11</td>
<td>.647</td>
<td>2.590</td>
<td>83.140%</td>
</tr>
<tr>
<td>12</td>
<td>.621</td>
<td>2.485</td>
<td>85.626%</td>
</tr>
<tr>
<td>13</td>
<td>.580</td>
<td>2.322</td>
<td>87.947%</td>
</tr>
<tr>
<td>14</td>
<td>.455</td>
<td>1.819</td>
<td>89.766%</td>
</tr>
<tr>
<td>15</td>
<td>.371</td>
<td>1.483</td>
<td>91.249%</td>
</tr>
<tr>
<td>16</td>
<td>.361</td>
<td>1.443</td>
<td>92.692%</td>
</tr>
<tr>
<td>17</td>
<td>.314</td>
<td>1.257</td>
<td>93.949%</td>
</tr>
<tr>
<td>18</td>
<td>.292</td>
<td>1.166</td>
<td>95.116%</td>
</tr>
<tr>
<td>19</td>
<td>.259</td>
<td>1.036</td>
<td>96.151%</td>
</tr>
<tr>
<td>20</td>
<td>.228</td>
<td>.913</td>
<td>97.064%</td>
</tr>
<tr>
<td>21</td>
<td>.213</td>
<td>.852</td>
<td>97.917%</td>
</tr>
<tr>
<td>22</td>
<td>.177</td>
<td>.707</td>
<td>98.623%</td>
</tr>
<tr>
<td>23</td>
<td>.131</td>
<td>.526</td>
<td>99.149%</td>
</tr>
<tr>
<td>24</td>
<td>.126</td>
<td>.504</td>
<td>99.653%</td>
</tr>
<tr>
<td>25</td>
<td>.087</td>
<td>.347</td>
<td>100.000%</td>
</tr>
</tbody>
</table>

The eigenvalue value describes the relative importance of each factor in computing the variance of the 25 variables analyzed. Based on the results of the formation of inhibiting factors for students to start entrepreneurship shows there are 7 factors formed from 25 variables are included. Each eigenvalue factor > 1. Factor 1 has eigenvalue of 7.421 with variance (29.683%), factor 2 has eigenvalue of 3.250 with variance (13%), factor 3 has eigenvalue 1.756 with variance (7.024%), factor 4 has eigenvalue 1.669 with
variance (6.675%), factor 5 has eigenvalue 1.342 with variance (5.366%), factor 6 has eigenvalue 1.190 with variance (4.760%), factor 7 has eigenvalue with 1,021 with variance (4.084%). The total variance of 25 variables extracted into 7 factors is 29.683% + 13% + 7.024% + 6.675% + 5.366% + 4.760% + 4.084% = 70.592%. That is, a new factor is formed of 70.592% while the remaining 29.408% is explained by other factors not examined.

Furthermore, the Scree Plot describes the relationship between the number of factors formed with the eigenvalue value in the form of the following graph.

In the scree plot the initial scree point indicates the factor formed before the scree point begins to level. Scree plot is related to Rotated component matrix. Rotated component matrix describes the magnitude of the correlation between the factors formed with the variables that exist.

<table>
<thead>
<tr>
<th>Tabel 4. Rotated Component Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>X1 : Obstacles 1</td>
</tr>
<tr>
<td>X2 : Obstacles 2</td>
</tr>
<tr>
<td>X3 : Obstacles 3</td>
</tr>
<tr>
<td>X4 : Obstacles 4</td>
</tr>
<tr>
<td>X5 : Obstacles 5</td>
</tr>
<tr>
<td>X6 : Obstacles 6</td>
</tr>
<tr>
<td>X7 : Obstacles 7</td>
</tr>
<tr>
<td>X8 : Obstacles 8</td>
</tr>
<tr>
<td>X9 : Obstacles 9</td>
</tr>
<tr>
<td>X10 : Obstacles 10</td>
</tr>
<tr>
<td>X11 : Obstacles 11</td>
</tr>
<tr>
<td>X13 : Obstacles 13</td>
</tr>
<tr>
<td>X14 : Obstacles 14</td>
</tr>
<tr>
<td>X15 : Obstacles 15</td>
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<td>X16 : Obstacles 16</td>
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<td>X17 : Obstacles 17</td>
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<td>X18 : Obstacles 18</td>
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<td>X19 : Obstacles 19</td>
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<td>X20 : Obstacles 20</td>
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<tr>
<td>X21 : Obstacles 21</td>
</tr>
<tr>
<td>X22 : Obstacles 22</td>
</tr>
<tr>
<td>X23 : Obstacles 23</td>
</tr>
<tr>
<td>X24 : Obstacles 24</td>
</tr>
<tr>
<td>X25 : Obstacles 25</td>
</tr>
</tbody>
</table>
Entrepreneurship is the most important factor in reducing the unemployment rate in Indonesia especially in educated unemployment, but for students to become an entrepreneur is the hardest step that will be traversed because there are several inhibiting factors that can cause the difficulties of students in starting a business. The inhibiting factors found by the researcher are: the basic ability factor of entrepreneurship which consists of the ignorance of the students on the way to be used in starting their business, the lack of courage, the lack of ability of students in seeking information, and the lack of knowledge, skills as the basic ability of the student in starting the business. Then, the morale factor which consists of the difficulty of the student in taking full responsibility for his business, due to long and unclear working hours, the wrong myths about entrepreneurship such as entrepreneurial ability is heredity, lack of experience and environment that does not support that makes students less struggling to start his business. Then, future uncertainty factors such as long and unclear working hours, fear of getting out of comfort zone, fear of risk) is called the Factor of Courage. Factor 5 (No capital, no one leading, requiring large capital) is named Resource Factor. Factor 6 (Risk of losing all investment, higher stress level) is named Risk Factor. Factor 7 (Less-motivating education system, lack of information on sources of capital) is named Information Factor.

After rotation and factor transformation, the final step is the naming of each factor. Factor 1 (Do not know how to start, lack the courage, lack of independent, lack of start-up information, lack of skills, lack of knowledge, lack of ideas) is given the name of the Basic Entrepreneurship Capability Factor. Factor 2 (Must take full responsibility, long and unclear working hours, wrong myths about entrepreneurship, lack of experience, unfavorable environment) is named Power Factor. Factor 3 (Low quality of life, non permanent employment) is named as Future Uncertainty Factor. Factor 4 (Uncertainty of income, perception of failure, fear of getting out of comfort zone, fear of risk) is called the Factor of Courage. Factor 5 (No capital, no one leading, requiring large capital) is named Resource Factor. Factor 6 (Risk of losing all investment, higher stress level) is named Risk Factor. Factor 7 (Less-motivating education system, lack of information on sources of capital) is named Information Factor.

V. CONCLUSION

Entrepreneurship is the most important factor in reducing the unemployment rate in Indonesia especially in educated unemployment, but for students to become an entrepreneur is the hardest step that will be traversed because there are several inhibiting factors that can cause the difficulties of students in starting a business. The inhibiting factors found by the researcher are: the basic ability factor of entrepreneurship which consists of the ignorance of the students on the way to be used in starting their business, the lack of courage, the lack of ability of students in seeking information, and the lack of knowledge, skills as the basic ability of the student in starting the business. Then, the morale factor which consists of the difficulty of the student in taking full responsibility for his business, due to long and unclear working hours, the wrong myths about entrepreneurship such as entrepreneurial ability is heredity, lack of experience and environment that does not support that makes students less struggling to start his business. Then, future uncertainty factors such as long and unclear working hours, fear of getting out of comfort zone, fear of risks arising. Then, the resource factor, consisting of the amount of capital needed, so the students do not have the capital, the absence of people who lead. Then, risk factors such as risk of losing all investment and higher levels of stress if students are entrepreneur. And the last factor of information, because the education system is less encouraging so that students difficult to obtain information related to business and lack of information about the source of their capital.

REFERENCES

Water Resource in Kenya: Impact of Climate Change/Urbanization


* IESD, College of Environmental Science and Engineering, Tongji University, Shanghai, P. R. China.

Abstract - Climate change is a major concern worldwide. The combination of climate change, rapid urbanization, industrialization, population growth, and low environmental awareness poses a major threat to Kenya’s valuable water resources, which are important to the country’s ecosystem. There is an urgent need to monitor and assess these resources, as this information is indispensable for sustainable decision-making and water resources management. The paper seeks to highlight the impacts of climate change and urbanization in Kenya and the strategies being implemented by the Government to mitigate or reduce these impacts as well as provide suggestions for future solutions.

Index Terms - Climate Change, Water Resources, Urbanization, Catchment Area.

I. INTRODUCTION

Kenya is a country located in East Africa and covers a total surface area of approximately 580,000 km² with an estimated population of 47.2 Million people. The climate in the country changes from tropical along the coast to arid in the interior. Kenya is classified as a water scarce country whose surface water resources cover only two percent of its total surface area. Per capita available water is about 650 m³/year, future projections show that by 2025, per capita water availability will drop to 235 m³ as a result of population growth. The bulk of Kenya’s renewable water resources are derived from an average annual rainfall volume of 322.77 billion cubic meters. Nairobi is the capital city of Kenya and like many urban towns it is experiencing serious population growth straining the already scarce natural resources. There is need to manage the current resources for a sustainable future.

II. EFFECTS OF URBANIZATION ON WATER RESOURCE MANAGEMENT

a. Population growth

Nairobi city is the capital of Kenya, the City has grown over the last 100 years from a settlement of 25km² to the current settlement of 684km² with an estimated population of 3.5 million Kenyans in 2012 this figure is projected to rise to 6.4 Million people by 2035. According to Athi Water services [1] investments in water supply infrastructure has lagged behind citing the third Nairobi water supply projection in 1994 as the most recent investment in water infrastructure. At the moment the demand for water in Nairobi city outstrip supply with a demand deficit of 170,000m³ per day and the figure is expected to rise to 280,000m³ per day by 2017 and 970,000m³ per day in 2035. Currently 65% of the city population receives safe and adequate water while the remaining 35% are either underserved or receive no water supply at all[1].

The main source of water supply for Nairobi is the Eastern Aberdare Rivers within the protected Aberdare Conservation Area which includes the Aberdare National Park and the Forest Reserves that surround the National Park. The total water supplied to Nairobi City currently is 580,000m³ per day against a demand of 750,000m³ per day in 2035. In an effort to meet the current demand the Government has embarked on a project whose main objective is to increase water supply in Nairobi County by 121,000m³ per day. The Northern Collector Tunnel is a project that seeks to improve water supply to Nairobi, Kiambu and Muranga Counties. The project will cost an estimated 6.8 billion Kenyan shillings. The Northern Collector Tunnel will divert defined flood flows from rivers
Maragua, Gikinge and Irati into Thika dam where both raw and filtered water will be transmitted into pipelines up to Kabete Treatment plant. The 11.8km that is 3m diameter pipeline will pass through critical natural habitats, protected areas, natural forests and densely populated areas; This has raised concerns from residents of Muranga county and politicians across board with the team highlighting that there is a possibility of the rivers running dry and they serve the main economic activity of the residents of Muranga county i.e. Farming. The project is part of Government’s Water Master Plan of 2012-2035 to be implemented by the Board in five phases[2].

b. Development of Informal Settlements

Another major impact of urbanization is the growth of informal settlements in the country and especially in the city. An example is Kibera, an informal settlement in Nairobi City which is home to 170,070 people according to a census held in 2009 by the Government.

![Figure 1: Population in Nairobi (in thousands)](image_url)

Most of the residents in these informal settlements live in extreme poverty earning less than $1.00 per day and unemployment rate is high. One of the challenges of managing water resource in informal settlements is the illegal connection to main supply lines often leading to contamination of treated water and disruption of supply in some areas within the city.

The water service provider has partnered with other organizations such as the World Bank to aid water connection in informal settlements through giving affordable and subsidized loans for informal settlement residents. The residents also receive water at subsidized rates and are provided with water kiosks and water automatic teller machines. Other than providing affordable water the Government initiated a clearance program to replace the informal settlements such as Kibera with residential districts of high rise apartments.

c. Water Pollution

Industrialization of the city of Nairobi has brought with it certain challenges to water resource management one of the major challenges is water pollution. Athi Water services Board highlighted the major water pollution challenges in the city of Nairobi as pollution from raw sewage which is overflowing from blocked or collapsed sewers as well as from filled up septic tanks and pit latrines, continued contamination of the aquatic environment by discharge of untreated or inadequately treated effluent from Dandora wastewater treatment plant, restricted access to waterborne sanitation for the population in informal settlements within Nairobi, continued menace of raw sewage flowing in open drains and continued accumulation of persistent contaminants in the environment[1].

Kenyans in the rural areas use wells for domestic water and pit latrines that are usually near the wells. This poses a threat because there is the likelihood of microorganisms traveling from the nearby pit latrines to the wells. The wells should be placed in elevated areas that is at least 2 meters above the water table and at least 15 meters from pit latrines, which is not the case in most overcrowded urban informal settlements [3]. A case study undertaken [4] provided an explanation for the severe contamination of drinking water in Kenya. The results indicated that contamination is largely as a result of the close distance between pit latrines and wells.

This cross-sectional study involved 192 respondents from Langas slum, Kenya. The Research made use of forty water samples that were checked for coliforms, thirty-one of the samples were from shallow wells while four were from deep wells and the remaining five were collected from taps. The study indicated that about 91% of informal settlements used wells as the
main source of water for domestic use while the rest use tap water. It was also noted that majority of informal settlers used pit latrines while thirty percent of children emit in open fields.

As indicated in the table below, the problem is that many wells were very close to the pit latrines. Out of 175 wells, about 39 percent of the wells were less than 15 meters from the latrines, about 59 percent were located within 15 and 30 meters and only about 3 percent were located 30 meters or more to pit latrines. All the samples taken from shallow wells were positive for total coliforms, which is fecal contamination. Three out of four samples taken from the deep wells were contaminated and none of the tap water samples were contaminated. From the extract below [4][3] it is clear that the growth of urban informal settlements have contributed to contamination of water.

<table>
<thead>
<tr>
<th>Distance</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-15 m</td>
<td>67</td>
<td>38.3</td>
</tr>
<tr>
<td>15-30 m</td>
<td>103</td>
<td>59.6</td>
</tr>
<tr>
<td>30 m and above</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
<td>175</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: [4]

Other reasons that were cited [4] as causes of water pollution in informal settlement include; children dipping dirty objects into water sources 34%, drawing water from the source using dirty containers 27%, domestic animals excreting around water sources 19% and people washing clothes at the water source 5%. The study concluded that water in langas slum / informal settlement was unsafe for human consumption. Langas informal settlement is a replica of water contamination in the various informal settlements in Nairobi which have grown as a result of urbanization.

d. Water Rationing
Currently the city of Nairobi is among the towns in Kenya that are under a water rationing program. The total water supplied to Nairobi City at the moment is 580,000m³ per day against a demand of 750,00m³ per day this has led to introduction of water rationing programs. The rationing program is also taking place in other towns in Kenya such as Nakuru and Meru who recently announced that they were engaging in a water rationing program because of low water levels in their reservoirs and the need to ensure distribution of water is done equitably. Other than reduction in the amount of water in catchment areas increasing population has also led to rationing as a temporary water management strategy but this will not be sustainable there is need to manage both population growth and at the same time source more water for the urban areas.

e. Solid Waste
Another major challenge in the city in relation to water resource management has been pollution by solid waste disposal into water bodies; Industrialization has led to increase in population which has increased consumption leading to an increase of waste in the city. Garbage dumping in Nairobi’s surface waters is common especially where it passes through informal settlements, case in point is the Nairobi River which not only navigates through informal settlements but also through the infamous Dandora dumpsite where all waste from the city of Nairobi is dumped. This has posed a great challenge when it comes to water resource management in the city of Nairobi. During rainy season manmade floods occur as a result of blockage of storm water drainage systems by solid waste materials such as plastic bags, this leads to pollution of surface waters as the storm water carries all solid waste matter along its course into receiving waters.

f. Destruction of Catchment Areas
Rampant urbanization and pressure for land and resources are pushing up against the forest boundaries. Encroachment and land grabbing is affecting water resource management in Kenya. A good example is the encroachment of Mau forest which is a Major water catchment area. The forest has witnessed serious deforestation over the years leading to reduction in precipitation which results to reduced water supply. Poor land-use activities; characterized by deforestation and clearance of bushes and other vegetation is the major cause of catchment degradation. Cultivation on steep slopes without applying soil conservation measures promotes soil erosion and rapid generation of surface runoff [11]. Vegetation cover is essential since it retards the flow of surface run-offs, thus encouraging more water to infiltrate into the soil and replenish soil moisture. The
recharge of ground-water aquifers also takes place through infiltration and deep percolation of rainwater. Other causes of the degradation of catchment areas include poor construction of roads and footpaths, which are sources of sediments carried by the surface run-off to river channels. Lack of effective urban planning mechanisms promotes development of informal settlements and other residential structures, which discharge Sewage and domestic wastewater into river channels and all this is escalated by occurrence of floods creating more challenges for water resource management[12].

g. Non-Revenue Water
As at 2014 Non-revenue water in Kenya was estimated to be at 42%. This indicates that nearly half of water treated after production is unaccounted for. Illegal connections to the distribution system have been a major challenge for water service providers in the country, the illegal connections have also been attributed to increasing urban population and decreasing water supply. Athi water services Board is in the process of facilitating rehabilitation of the water distribution system to be able to mitigate such connections and account for any technical losses incurred during distribution.

III. EFFECTS OF CLIMATE CHANGE ON WATER RESOURCES

a. Drought
Over the past decade Kenya has experienced severe drought. Global warming is one critical factor that has prolonged the drought and as a result, millions of Kenyans are unable to grow their crops and keep their livestock alive[3]. The drought has affected water resources in Kenya and this was experienced and declared national disasters in the years January 1997, December 2000, March to June 2004 and December 2005. This indicates that in the last decade alone there have been four cases of major food crisis all as a result of drought. This is as a result of climate change and has posed a challenge by reducing the amount of water resources that are already scarce.

In 2009 the dry season was longer than usual and the Thika Dam reservoir which is the main source of water for Nairobi residents with a storage capacity of 70m cubic meters, held only 26m cubic meters of water at the height of the drought. Environmentalists attributed the low water levels not only to the failed rains that is climate change, but also to the destruction of forests in the Aberdare range leading to erosion which reduced the storage capacity of the reservoir. The Nairobi water utility drilled emergency wells during the drought and connected them to the piped network, this meant that the company reverted to relying on ground water after phasing it out a decade ago.

According to the Food and Agriculture Organization, Kenya is set to experience more dry weather in the first quarter of 2017 [5]. An estimated 1.3 million people are likely to go hungry as a result of crop failure, loss of livestock and lack of fresh water. This has been attributed to total failure of short rains which normally occur between November and December. This has led to the decision by the government to agree to the first of many desalination projects along the Kenyan coast to provide water for the coastal communities.[6] The desalination project will produce 10,000 litres of drinking water a day to serve about 3,500 people in Lamu County. Climate change in Kenya has led to droughts, case in point is in Lamu County which solely relies on rain water harvesting because it’s residence lack local freshwater sources such as rivers or natural wells. Water that had been stored during past rainy seasons is quickly running out of stock hence the need to source for water from the ocean.

b. Floods
Floods and droughts are associated with extreme climate events. In contradiction, the country has also suffered from floods and droughts. Most parts of Kenya have two rainy seasons, March to May (long rains) and October to November (short rains) with the intensity of these rains having increased recently due to increased climate variability. In addition to annual local floods, the country experienced major floods in 1961 and in 1997/1998[7]. Floods can occur at any time, but weather/climate patterns have a strong influence on when and where floods occur[8]. The land management practices in the upper catchments may also contribute to the enhancement of surface water run-off and flooding and an unplanned human occupation in the lowland can also enhance the damages due to flooding.

During April and May 2003, Budalangi in Western Kenya experienced flooding at the lower Nyando River basin[9]. The heavy rains led to water supply disruption in urban and rural centers and washing away of river gauging facilities constructed along the rivers. After the April / May 2003 flooding it was evident that the Nyando River flooded downstream breaching the dykes of both Nzoia and Nyando river. Washing away of data loggers, water-level recorders, river gauging structures and bridges, affecting communication and flow monitoring activities in the field[10].

IV. CONCLUSION

Climate Change and urbanization are major considerations for water resource management in Kenya. The change in climate could lead to floods or even drought depending on the area in the country. Recently, the country has experienced floods which affected distribution of water supply within the city of Nairobi due to interference and even destruction of certain parts of the distribution system; on the other hand, droughts have led to reduction of water levels in the various water reservoirs resulting to a reduction in water supply straining the current water rationing program in place. Urbanization is also stretching water resource management by increasing water demand. The growth of informal settlements has led to an increase in water pollution through various human activities as a result of poor sanitation and discharge of raw waste into water bodies from various non-point sources in the informal settlements. The Kenyan Government has initiated several projects to mitigate these impacts or reduce their effects such as the northern collector to provide more water for Nairobi residents, implementation of county government to develop each county and devolution of resources to mitigate rural urban migration controlling population growth in Nairobi city and clearance of informal settlements by building affordable residential apartments for people living in the informal settlements. The Kenyan Government has initiated several projects to mitigate these impacts or reduce their effects such as the northern collector to provide more water for Nairobi residents, implementation of county government to develop each county and devolution of resources to mitigate rural urban migration controlling population growth in Nairobi city and clearance of informal settlements by building affordable residential apartments for people living in the informal settlements. The Kenyan Government has initiated several projects to mitigate these impacts or reduce their effects such as the northern collector to provide more water for Nairobi residents, implementation of county government to develop each county and devolution of resources to mitigate rural urban migration controlling population growth in Nairobi city and clearance of informal settlements by building affordable residential apartments for people living in the informal settlements. The Kenyan Government has initiated several projects to mitigate these impacts or reduce their effects such as the northern collector to provide more water for Nairobi residents, implementation of county government to develop each county and devolution of resources to mitigate rural urban migration controlling population growth in Nairobi city and clearance of informal settlements by building affordable residential apartments for people living in the informal settlements. The Kenyan Government has initiated several projects to mitigate these impacts or reduce their effects such as the northern collector to provide more water for Nairobi residents, implementation of county government to develop each county and devolution of resources to mitigate rural urban migration controlling population growth in Nairobi city and clearance of informal settlements by building affordable residential apartments for people living in the informal settlements.  

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Impact of Demonetisation and GST in Life Insurance Sector

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Abstract- Demonetization is the act of stripping a currency unit of its status as legal tender. It occurs whenever there is a change of national currency. The current form of money is pulled from circulation and retired, often to be replaced with new notes or coins. Sometimes, a country completely replaces the old currency with new currency (Sundar, 2017). This paper deals with Impact of Demonetization and Goods and Service Tax (GST) on Life insurance sector. It outlines the effects of demonetization and GST on the Life of insurance agents, awareness among the customers and procuration of new business. For this purpose a sample of 130 was collected from the Life insurance employees of Cochin region based on random sampling method. Descriptive statistics and Anova test were used to analyse the data. The conclusion is that demonetization and GST have a positive impact in Life insurance sector.

Index Terms- Demonetisation, Good and Service Tax, Agents, Customers

I. INTRODUCTION

DEMONETISATION

Demonetisation of currency means discontinuity of the particular currency from circulation and replacing it with a new currency. In the current context it is the banning of the 500 and 1000 denomination currency notes as a legal tender. Government of India announced demonetisation of the high value currencies of Rs. 500 and 1000 with an objective to unearth the black money and to curb the corruption, counterfeit currency as well as terror funding. This decision is considered as biggest cleanliness drive against the black money in the history of Indian economy whose benefits will be reaped in the long run (Uke, February 2017).

According to the report released by Insurance Regulatory and Development Authority of India (IRDAI), the individual single premiums collected in November 2016 for all Life insurance subscriptions were Rs 6,692 crore. There is an increase of 507% more than what was collected in November 2015. The insurance segment grew by 170% from Rs2,481 crore collected in October 2016. The total amount of first-year premiums (both regular and single premium) grew 113% on a year-on-year basis, and 45% compared to the collections in October 2016. The insurance industry, which was growing at a decent 28% on a month-on-month basis, grew more than 40% in November 2016. It was a pleasant surprise for all players in the sector (kannaiah, 2017).

II. GST

Goods and Services Tax, popularly known as GST, is a reform for our economy’s indirect tax plan. On 8th August 2016, GST Bill (which was long pending) was passed in Lok Sabha. It was possible after a very long journey flooded with challenges, confrontations, and what not. At last, the GST bill has entered the phase of implementation, which will come into effect from July 1, 2017. GST would make changes in the tax structure between the center and the state. GST is a VAT, i.e. Value Added Tax that will eradicate the cascade effect/ double taxation from the price of goods and services down the value chain. It would surely affect the incidence, structure, and calculation of the indirect taxes, which will lead to a comprehensive refurbishment of the current tax system in India.

A policyholder pays service tax only on the risk factor of the premium element, whereas the investment component of the insurance plans usually isn’t included in the service tax umbrella. After the GST is implemented, insurance plans, including Life, motor, and health would become more expensive, as taxes would be hiked (Pudari, 2017).

III. NEED FOR THE STUDY

Life insurance provides an infusion of cash for dealing with the adverse financial consequences of the insured's death. Life insurance enjoys favorable tax treatment unlike any other financial instrument. Death benefits are generally income-tax-free to the beneficiary. However the implementation of demonetization and GST have a major impact in Life insurance products. The study covers procuration of new business, collection of renewal premium, awareness among the customers, need of training for insurance people to adapt to the changes and growth of Life insurance.

IV. RESEARCH GAP

There are some articles available separately as Demonetisation and GST on insurance products. But no research was done with Ernakulam region. Also most of the studies were
conducted through secondary data and no primary data was collected from the customers, agents and officials.

**THEORETICAL FRAMEWORK**

The demonetization and GST have a great significant and immediate impact on the state of the Indian economy. In this paper, an attempt has been made to find impact of demonetization and GST on insurance segment. Samples of 130 respondents were randomly selected from Ernakulam District. The study was conducted mainly on four areas such as threat to job, current sales position, customer behaviour, future business scope.

V. HYPOTHESIS

**H01:** There is no influence of demonetization and GST in business of insurance agents.

**H02:** There is no significant relationship between attitude of customers and GST.

VI. OBJECTIVES OF THE STUDY

i) To analyze the effect of demonetization in Life insurance in terms of positive or negative.

ii) To understand about people’s attitude towards buying insurance products.

iii) To analyze the impact on job of insurance agents.

iv) To analyze the growth of Life insurance.

VII. RESEARCH METHODOLOGY

Research methodology is a way to systematically solve the research problem. Research methodology used in this study is Descriptive in nature. For this study, the data and information has been collected with the help of questionnaires, journals and articles.

VIII. SAMPLING DESIGN & TOOLS APPLIED

**Sampling techniques**

Sampling Unit:

Sampling unit can be defined as the basic unit containing the Life insurance officials of Ernakulam city.

**Sampling Size:**

In this research, the sample size amount to one hundred and thirty, which are surveyed from Life insurance officials of Ernakulam city. And also, the statistical tool are applied viz. (a) Descriptive statistics 
(b) Anova Test

IX. DATA COLLECTION

Data has been collected from 130 respondents by using primary source of data collection and secondary source of data collection

a) **Primary Source of data collection:** In primary method of data collection, data has been collected by taking personal interviews of insurance agents, officials and customers and collect the responses from questionnaire and by observing the behavior.

b) **Secondary Source of data collection:** In secondary source of data collection, data has been collected from journals, newspapers, magazines, and websites.
X. DATA ANALYSIS

Agents

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Business Performance</td>
<td>60</td>
<td>2.10</td>
<td>1.003</td>
</tr>
<tr>
<td>Income earning</td>
<td>60</td>
<td>2.10</td>
<td>1.003</td>
</tr>
<tr>
<td>Security of business</td>
<td>60</td>
<td>1.82</td>
<td>0.537</td>
</tr>
<tr>
<td>Area of work</td>
<td>60</td>
<td>1.67</td>
<td>0.629</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INTERPRETATION
Total number of agents 60

The above data shows the impact of demonetisation and GST in business of agents. Demonetisation and GST have a positive impact in the business of agents. The business of insurance agents flourished compared to the sales before demonetisation and GST. Customers were investing in insurance leading to the growth of business of agents. Agents were focusing on the sale of Jeevan Akshay single premium policy. Agents received high rate of commission through the sale of single premium policies. Thereby business of insurance agents increased.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth in business</td>
<td>60</td>
<td>3.38</td>
<td>1.648</td>
</tr>
<tr>
<td>Change in profession</td>
<td>60</td>
<td>2.52</td>
<td>1.692</td>
</tr>
<tr>
<td>Suggestion of agency</td>
<td>60</td>
<td>3.53</td>
<td>1.443</td>
</tr>
<tr>
<td>Training</td>
<td>60</td>
<td>3.35</td>
<td>1.665</td>
</tr>
<tr>
<td>Customer aware of increase in premium</td>
<td>60</td>
<td>4.33</td>
<td>1.068</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INTERPRETATION
Total number of officials 20

From the above table we can understand that the Life insurance business has increased after implementation of demonetisation and GST. Sale of single premium policies have increased. Customer response towards the Life insurance industry is slightly affected because of the increase in premium amount. Future of Life insurance industry will be good as new policies were introduced according to the current market scenario.

Customers

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest in insurance has come down</td>
<td>50</td>
<td>2.62</td>
<td>1.398</td>
</tr>
<tr>
<td>Insurance industry is badly affected</td>
<td>50</td>
<td>2.62</td>
<td>1.398</td>
</tr>
<tr>
<td>Aware of increase in premium due to GST</td>
<td>50</td>
<td>3.90</td>
<td>1.233</td>
</tr>
<tr>
<td>Convincing customers</td>
<td>50</td>
<td>3.32</td>
<td>1.421</td>
</tr>
<tr>
<td>Future of insurance business will be good</td>
<td>50</td>
<td>3.32</td>
<td>1.421</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INTERPRETATION:
Total number of customers 50

Insurance industry is slightly affected by the implementation of demonetisation and GST. As there is an increase in the premium amount due to GST, some customers are not willing to buy policy. Most of the customers are aware about the increase in premium amount. Agents were able to convince the customers to an extent. New policies are introduced to cope up with current market scenario, so that the future of insurance industry will be good.

HYPOTHESIS TESTING

H01: There is no influence of demonetization and GST in business of insurance agents.
ANOVA

<table>
<thead>
<tr>
<th>New_Business_Performance</th>
<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>24.205</td>
<td>2</td>
<td>12.102</td>
<td>19.600</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>35.195</td>
<td>57</td>
<td>.617</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59.400</td>
<td>59</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Income_earning</th>
<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>24.205</td>
<td>2</td>
<td>12.102</td>
<td>19.600</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>35.195</td>
<td>57</td>
<td>.617</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59.400</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As the significance level .000 is less than .05 null hypothesis is not accepted. There is influence of demonetization and GST in job of insurance agents. Income earning of agents has changed due to demonetization and GST. Agents focusing on high income earning customers have a positive impact whereas agents focusing on low income earning customers have negative impact. The amount of commission insurance agents receive has changed. Agents who are affected have a fear of job loss.

**H02 :** There is no significant relationship between attitude of customers and GST.

ANOVA

<table>
<thead>
<tr>
<th>Aware of increase in premium_due_to_GST</th>
<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>20.988</td>
<td>4</td>
<td>5.247</td>
<td>4.412</td>
<td>.004</td>
</tr>
<tr>
<td>Within Groups</td>
<td>53.512</td>
<td>45</td>
<td>1.189</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>74.500</td>
<td>49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Null hypothesis is not accepted as the significance level is .004 less than .05. So there is significant relationship between attitude of customers and GST.

XI. FINDINGS

Insurance industry is positively affected after the implementation of demonetisation and GST. Sale of single premium policy have increased as the customers wants to invest money in bulk. Thereby there is an increase in growth of business. Agents dealing with premium customers have a positive impact as their commission rates were increased compared to sales before demonetisation and GST. Agents dealing with middle and low income earning customers were slightly affected as there is an increase in the premium amount some customers were not willing to purchase policies. So the commission of those agents decreased. In order to increase the Life insurance policy sale, new policies have introduced according to the current market scenario. Rural areas are slightly affected because most of the customers are middle or low income earners. Most of the insurance agents are full time agents.

XII. LIMITATIONS

There may be a bias in collection of primary data towards the research. The research was conducted in Ernakulam region only. The data collected from the respondents were limited to 130.

XIII. CONCLUSION

The insurance market will expand as income of the individual and business is expected to rise. As of now the implementation of demonetisation and GST have a positive impact in Life insurance industry. The sale of insurance policies are much higher compared to the sales before demonetisation and GST. There is also a positive impact in the business of insurance agents. Future of the insurance industry will be good as new policies were introduced to cope up with the current market situation.

REFERENCES


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Modeling and Forecasting Africa's GDP with Time Series Models

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Abstract—Forecasting economic growth for developing countries is a problematic task, peculiarly because of particularities they face. The model identification process in this paper yielded a random walk model for the Gross Domestic Product (GDP) series. We applied ARIMA models to get empirical results and bring to a close that the models obtained are suitable for forecasting the economic output of Africa. The adequate models were used for each of 20 Africa's largest economies to forecast future time series values. Based on the estimation results, we concluded that from 1990 looking forward to 2030, there will be an increasing GDP growth where the average speed of the economy of Africa will be of 5.52%, and the GDP could achieve $2185.21 billion to $10186.18 billion.

Keywords: Africa, ARIMA Model, Economic Growth, Forecasting.

I. INTRODUCTION

While the rest of the world's economy grew at an annual rate of close to 2% from 1960 to 2002, growth performance in Africa has been hopeless. From 1974 through the mid-1990s, growth was negative, reaching negative 1.5 percent in 1990-4. As a consequence, hundreds of millions of African citizens have become poor: one half of the African continent lives below the poverty line. According to the 2012 Africa Millennium Development Goals (MDGs) report, Africa has made a huge progress. The report states that between 1990 and 2008, the number of Africans living under US$1.25 per day decreased from 56.5% to 47.5%, and the number of poor people fell from 394.9 million to 386 million. Africa is the world's second-fastest growing economy behind South Asia. In 2013, Africa was the world's fastest-growing continent at 5.6% a year. Estimated to have strengthened from 1.3% in 2016 to 2.4% in 2017, the GDP growth in the region is mainly led by the largest economies: Nigeria, South Africa, and Angola. Where, According to African Development Bank, Nigeria and South Africa account for the largest share of Africa’s GDP with 29% and 19%, respectively (Bank 2017). In this paper, we made a projection of the GDP growth for fourteen years ahead that is from 2016 to 2030. This paper also points out the largest region in the continent and the largest country's economic growth. According to the result obtained, we suggest that each Country must have its focal point on comprehensive development of economic growth. The Government of a Country must know how to adjust to low oil prices, depressed revenues, and rising debt levels, each Country should increase its infrastructure investment. Each Country should increase the public investment and each Country must ensure its Political stability.

II. OBJECTIVES OF THE STUDY

The main objective of this study is to model and forecast the Gross Domestic Product of Africa using Time Series models. In the study, we present the largest economy of Africa by regions and give a macro number upon which many African businesses and governments could base their decisions with respect to investment, hiring, and spending.

III. DATA AND METHODOLOGY

From the World Bank database, we collected GDP data for 26 years from 1990 to 2016, analyzed and forecasted them for 14 years ahead. The sample is composed of twenty biggest economies in terms of the size of GDP: Equatorial Guinea, Gabon, Zambia, Uganda, Cameroon, Ivory Coast, Democratic Republic of Congo, Tanzania, Tunisia, Ghana, Ethiopia, Kenya, Sudan, Libya, Morocco, Angola, Algeria, and Egypt. In this study, E-views 9 have been used for statistical analysis.
differences and q is the number of moving average lags. Let us assume the series $y_t$ which can be stationary after $d$ times of differentiating, i.e. $y_t \sim I(d)$ then, $u_t = \Delta^d y_t = (1 - B)^d y_t$ where $u_t$ is stationary series, i.e. $u_t \sim I(0)$ and in this case the ARIMA (p, q) model will be as follow:

$$\text{ARIMA}(p, q): (1 - L)^d \varphi(L) y_t = c + \theta(L) e_t$$

Where $\varphi^*L$ is defined in $\varphi(L) = (1 - L)\varphi^*(L)$, with $\varphi^* \neq 0$ for all $|z| \leq 1$ and $\theta(L)$ is defined in $\theta(z) \neq 0$ for all $|z| \leq 1$. Hamilton and Samuel stated that ARIMA models are always used in situations where time series show evidence of non-stationary by using an initial differencing step to remove the non-stationary(Hamilton and Susmel 1994).

The advantages of the ARIMA models are not only to speculate the influence of systematic factors such as continual advancement of technology, and sustainable growth of workforce, continual improvement of educational level, continual formation of capital, continual improvement of total factor productivity, but also includes many unobservable factors such as change of system, change of climate, etc.(Wang 2016).

IV. ANALYSIS AND FINDINGS

For the analysis, we adopted different calculating method and refer to the methodology used by Wang for Shenzhen GDP Forecasting (Wang 2016), Ince and Molodtsova for rationality and forecasting accuracy (Ince and Molodtsova 2017) and Oluwatayo and Ojo for economic growth and poverty in Africa (Oluwatayo and Ojo 2018).

To reach the objective, we made the following Hypothesis:

$H_0$: An increasing trend will appear for African economic growth for the 14 upcoming years

$H_1$: An increasing trend will not appear for African economic growth for the 14 upcoming years

The steps taken to analyze and test the above hypothesis are

Step-1 To plot the data as time series
Step-2 To perform the first and second difference to make the data stationary
Step-3 To plot ACF and PACF to identify potential AR and MA model
Step-4 Identification of best fit ARIMA model
Step-5 Forecast the GDP using the best fit ARIMA model
Step-6 Plot the ACF and PACF for residuals

the data are not stationary and then we proceed for differetiation. After the first difference of the data, the GDP data of Algeria, Cameroon, Ivory Coast, DRC, Egypt, Equatorial Guinea, Ethiopia, Ghana, Libya, Morocco, Tunisia, Uganda, and Zambia become stationary.

The first difference of the data is not stationary for Angola, Gabon, Kenya, Nigeria, South Africa, Sudan and Tanzania. Therefore, we perform the second difference and the second difference render the data stationary. Since all the data are now stationary, we can apply Box–Jenkins methodology and select the best fit model. The ARIMA models established using B-J method are obtained in the following table.

<table>
<thead>
<tr>
<th>Country</th>
<th>ARIMA model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>(1,1,6)</td>
</tr>
<tr>
<td>Angola</td>
<td>(3,2,1)</td>
</tr>
<tr>
<td>Cameroon</td>
<td>(1,1,2)</td>
</tr>
<tr>
<td>DRC</td>
<td>(1,1,3)</td>
</tr>
<tr>
<td>Egypt</td>
<td>(1,1,1)</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>(1,1,6)</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>(1,1,1)</td>
</tr>
<tr>
<td>Gabon</td>
<td>(3,2,1)</td>
</tr>
<tr>
<td>Ghana</td>
<td>(5,1,1)</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>(1,1,0)</td>
</tr>
<tr>
<td>Kenya</td>
<td>(1,2,2)</td>
</tr>
</tbody>
</table>

Figure 1: Time plot of Annual GDP series (1990-2016)
The observed forecasted values are shown in Table 2 and the actual numerical values are used to compute errors. The data demonstrate that the predicted values are much closer to actual values, and average prediction errors are calculated as 1.5%, approximating to 2% points, which shows a good fitting effect and higher prediction precision of the model. Therefore this model can be used to predict the actual GDP of Africa.

Table 2: Forecasted values

<table>
<thead>
<tr>
<th></th>
<th>Algeria</th>
<th>Angola</th>
<th>Cameroon</th>
<th>DRC</th>
<th>Egypt</th>
<th>Eq. G.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>162.78</td>
<td>99.96</td>
<td>29.97</td>
<td>40.44</td>
<td>333.00</td>
<td>10.57</td>
</tr>
<tr>
<td>2018</td>
<td>166.52</td>
<td>102.75</td>
<td>30.61</td>
<td>40.83</td>
<td>333.95</td>
<td>10.95</td>
</tr>
<tr>
<td>2019</td>
<td>170.26</td>
<td>103.51</td>
<td>31.25</td>
<td>40.48</td>
<td>335.13</td>
<td>11.34</td>
</tr>
<tr>
<td>2020</td>
<td>173.99</td>
<td>105.24</td>
<td>31.89</td>
<td>39.42</td>
<td>336.49</td>
<td>11.72</td>
</tr>
<tr>
<td>2021</td>
<td>177.73</td>
<td>106.94</td>
<td>32.53</td>
<td>37.70</td>
<td>338.00</td>
<td>12.11</td>
</tr>
<tr>
<td>2022</td>
<td>181.47</td>
<td>108.61</td>
<td>33.17</td>
<td>35.39</td>
<td>339.61</td>
<td>12.50</td>
</tr>
<tr>
<td>2023</td>
<td>185.20</td>
<td>110.26</td>
<td>33.81</td>
<td>32.61</td>
<td>341.31</td>
<td>12.88</td>
</tr>
<tr>
<td>2024</td>
<td>188.94</td>
<td>111.89</td>
<td>34.45</td>
<td>29.50</td>
<td>343.08</td>
<td>13.27</td>
</tr>
<tr>
<td>2025</td>
<td>192.68</td>
<td>113.49</td>
<td>35.09</td>
<td>26.20</td>
<td>344.90</td>
<td>13.66</td>
</tr>
<tr>
<td>2026</td>
<td>196.41</td>
<td>115.07</td>
<td>35.73</td>
<td>22.88</td>
<td>346.76</td>
<td>14.04</td>
</tr>
<tr>
<td>2027</td>
<td>200.15</td>
<td>116.63</td>
<td>36.37</td>
<td>19.70</td>
<td>348.65</td>
<td>14.43</td>
</tr>
<tr>
<td>2028</td>
<td>203.89</td>
<td>118.16</td>
<td>37.01</td>
<td>16.80</td>
<td>350.57</td>
<td>14.82</td>
</tr>
<tr>
<td>2029</td>
<td>207.62</td>
<td>119.68</td>
<td>37.65</td>
<td>14.34</td>
<td>352.51</td>
<td>15.20</td>
</tr>
<tr>
<td>2030</td>
<td>211.36</td>
<td>121.18</td>
<td>38.29</td>
<td>12.43</td>
<td>354.47</td>
<td>15.59</td>
</tr>
</tbody>
</table>

From Table 2, we can state that the economic growth of Africa has an increasing trend and accept the Null hypothesis. An increasing trend will appear for African economic growth for the 14 upcoming years.

Figure 2: East Africa GDP forecast

Figure 3: West Africa GDP forecast
The economic growth in Northern Africa has a changing magnitude over the course of the coming 14 years. However, growth prospects remain weak in the Central African Economic and Monetary Community (CEMAC) countries. East Africa Community (EAC) countries continue to be the fastest growing economy while Southern Africa is projected to see a down slope. When comparing the GDP of all the twenty countries, we find that by 2030, Ethiopia will be the biggest economy.

For testing the forecast accuracy, we especially consider the aspect of Theil Inequality Coefficient which is the systematic error given by:

$$ TIC = \frac{\sqrt{\frac{1}{T} \sum_{t=1}^{T} f(t \sigma^2 + \sigma^2)^2}}{\sqrt{\frac{1}{T} \sum_{t=1}^{T} (\sigma^2)^2} + \sqrt{\frac{1}{T} \sum_{t=1}^{T} f(t \sigma^2)^2}} $$

Where $f$ represents the forecast horizons. For the values of Theil Inequality Coefficient, if equals to zero then we have a perfect fit meaning that the actual and forecasted variable is same and there is no error, therefore the predictive power is perfect. If equals to 1, then the predictive power is the worst and if between zero and 1 then the predictive power is the best.

<table>
<thead>
<tr>
<th>Country</th>
<th>Theil Inequality</th>
<th>Bias Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camero on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eq. G.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gabon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ghana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iv. Co</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Libya</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morocco</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. Africa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zambia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Based on regions, the first, second, third, fourth and fifth top are respectively East, North, West, South, and Central Africa. Our findings are in line with that of Rodrik, Fedderke and Oluwatayo (Rodrik 2016), (Fedderke and Mengisteab 2017), (Oluwatayo and Ojo 2018). Each country forecasted GDP value of the year 2030 is 211.36 billions of dollars, 121.18 billions of dollars, 38.29 billions of dollars, 12.43 billions of dollars, 354.47 billions of dollars, 15.59 billions of dollars, 6778.66 billions of dollars, 14.49 billions of dollars, 60.44 billions of dollars, 67.81 billions of dollars, 181.57 billions of dollars, 39.35 billions of dollars, 143.14 billions of dollars, 590.28 billions of dollars, 383.56 billions of dollars, 768.00 billions of dollars, 292.16 billions of dollars, 57.47 billions of dollars, 34.03 billions of dollars and 21.90 billions of dollars respectively for Algeria, Angola, Cameroon, Democratic Republic of Congo, Egypt, Equatorial Guinea, Ethiopia, Gabon, Ghana, Ivory Coast, Kenya, Libya, Morocco, Nigeria, South Africa, Sudan, Tanzania, Tunisia, Uganda and Zambia.

Among countries, Ethiopia comes first with a GDP amount of 6778.66 billion US Dollars and Democratic Republic of Congo (DRC) is the last with an average growth rate of -13.3% that is, 12.43 billion US dollars. Our findings show that the ten largest economies by 2030 will be: Ethiopia, Sudan, Nigeria, South Africa, Egypt, Tanzania, Algeria, Kenya, Morocco and Angola.

<table>
<thead>
<tr>
<th>Country</th>
<th>Coefficient</th>
<th>2030 GDP (Billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>0.07</td>
<td>2%</td>
</tr>
<tr>
<td>Angola</td>
<td>0.11</td>
<td>13%</td>
</tr>
<tr>
<td>Cameroon</td>
<td>0.05</td>
<td>9%</td>
</tr>
<tr>
<td>DRC</td>
<td>0.1</td>
<td>1%</td>
</tr>
<tr>
<td>Egypt</td>
<td>0.04</td>
<td>6%</td>
</tr>
<tr>
<td>Equatorial Guinea</td>
<td>0.11</td>
<td>4%</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>0.06</td>
<td>11%</td>
</tr>
<tr>
<td>Gabon</td>
<td>0.08</td>
<td>20%</td>
</tr>
<tr>
<td>Ghana</td>
<td>0.13</td>
<td>48%</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>0.05</td>
<td>13%</td>
</tr>
<tr>
<td>Kenya</td>
<td>0.04</td>
<td>29%</td>
</tr>
<tr>
<td>Libya</td>
<td>0.17</td>
<td>1%</td>
</tr>
<tr>
<td>Morocco</td>
<td>0.03</td>
<td>14%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>0.09</td>
<td>8%</td>
</tr>
<tr>
<td>South Africa</td>
<td>0.04</td>
<td>6%</td>
</tr>
<tr>
<td>Sudan</td>
<td>0.05</td>
<td>23%</td>
</tr>
<tr>
<td>Tanzania</td>
<td>0.04</td>
<td>29%</td>
</tr>
<tr>
<td>Tunisia</td>
<td>0.03</td>
<td>15%</td>
</tr>
<tr>
<td>Uganda</td>
<td>0.05</td>
<td>12%</td>
</tr>
<tr>
<td>Zambia</td>
<td>0.08</td>
<td>9%</td>
</tr>
</tbody>
</table>

V. DISCUSSION

Based on the findings, we can see that GDP data are non-stationary series as shown in figure 1. Therefore, the Dickey-Fuller test was performed to confirm the stationarity. The ARIMA model that fits best for the 20 continent's largest economies is presented in table 1. From figure 2 to 6, we can see that the growth rate shows a rising tendency for Algeria, Angola, Cameroon, Ivory Coast, Equatorial Guinea, Ghana, Kenya, Morocco, Nigeria, South Africa, Sudan, Tanzania, Tunisia, and Zambia while for Gabon and Uganda the economic growth rate goes up and down. Libya has an increasing then a decreasing then a constant tendency. A slight raising economic growth tendency is observed for Egypt and a gradually raising for Ethiopia. A falling tendency for the Democratic Republic of Congo with an average growth rate around 1.8%, 1.3%, 1.7%, -13.3%, 0.6%, 2.6%, 49.7%, 1.3%, 2.1%, 4.7%, 7.0%, 0.0%, 2.0%, 23%, 1.8%, 25.9%, 12.7%, 2.0%, 2.2%, and 2.0% for Algeria, Angola, Cameroon, Ivory Coast, Equatorial Guinea, Ghana, Kenya, Morocco, Nigeria, South Africa, Sudan, Tanzania, Tunisia, and Zambia respectively.

The result in figure 7 means that among twenty largest economies, Ethiopia comes on top with a GDP amount of 6778.66 billion US Dollars. The result in table 2 means that a significant forecast ability is obtained for all countries and the Bias Proportion or the systematic error shows that the gap between the actual variable and the predicted variable is small.

VI. CONCLUSION

The present study tries to forecast the economic growth of Africa in 14 years ahead. The study shows that the economic growth of Africa has an increasing trend and there is a high economic growth trend of about 5.52% and GDP can achieve $2185.21 billion to $10186.18 billion by 2030.

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A Concept of Dhatri & Human Milk Banking

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Abstract- Ancient science and its basic fundaments are as useful as in modern time. In ancient time Acharya knows very well and aware about newborn baby nutrition is well explained in our classics text. When mother is unable to feed her child due to any reason, the concept of dhatri (wet nurse) is described by Acharya. In present contest, science and technology developed but they do not develop artificial milk as useful as mother milk, so they solve problem by collecting human milk in the milk bank. Dhatri (wet nurse) can store her milk in milk bank so later they provide milk to baby. During ancient time preservation of the milk was not available but today with the help of science and technology human milk can store and preserve and supply needy baby.

Index Terms- Dhatri, Nutrition, Artificial milk, Human milk

I. INTRODUCTION

Milk is the optimal food for almost all infants in the first year of life. The breast milk provides numerous health benefits to both mother and baby. Milk is the primary source of nutrition for newborns; older infants and toddlers may continue to be breastfed, either exclusively or in combination with other foods from around six months of age when solid foods may be introduced. In our country, the burden of high risk newborns in various hospitals is about 20% with significant mortality and morbidities due to nonavailability of milk.

II. HISTORY

4 In Mahabharata, there is description of Dhatri in the absence of mother milk, also lord Krishna feed by Dhatri Yashodaz while Devaki was in prison. 5The first milk bank in Asia under the name of Sneha, Founded by Dr. Armeda Fernandez, was started in Dharavi, Mumbai on November 27, 1989. Around 1970 there was loss of interest towards milk bank. 6The reason for this loss of interest was the heavy promotion of infant formula, including formulas specially designed for preterm infants. Later, a fear of transmission of viruses, including HIV, in body fluids led to an anxiety about donation of body fluids, including breast milk. 7 WHO and UNICEF, made a joint statement in 1980,"Where it is not possible for the biological mother to breastfeed, the first alternative, if available, should be the use of human milk from other sources".

III. CONCEPT OF DHATRI

8 Acharya Vagbhata advised for arrangement of two wet nurses in condition of inability for feeding the baby by the mother. Examination of wet-nurses (including physical, physico-psychological qualities) have been described in Ayurvedic literature, so that breast feeding result in proper growth and development in child.

IV. SCREENING OF DHATRI/MOTHER FOR MILK BANK:

9 Charaka says that wet-nurse should be
- Modest
- No-addiction
- Similar in desha and jati (sub caste)
- Affectionate to the child
- Free from diseases
- Jivitvatsa (having alive child)
- Samman-varna (similar in the caste)
- Young
- Having adequate amount of breast milk etc.

One of the major issues, milk banking faces is the possibility of transmission of an infectious disease via the milk. Parents may fear accepting donated milk for this reason, while doctors may feel that the benefits of donated milk are outweighed by the possible legal implications. Consequently, screening is extremely important for milk banking like for HIV, VDRL, HbsAg etc.

V. EQUIPMENTS

14 Pasteurizer/Shaker-water bath: It is essential to have a device to carry out heat treatment of donor milk at the recommended temperature of 62.5°C for a period of 30 minutes (Pretoria Holder pasteurization method) prior to its use.

Deep freezer: A deep freezer to store the milk at -20 degree Celcius is essential in the milk bank.

Refrigerators: 15 These are required to store the milk till the whole day’s collection is over and the milk is ready to be mixed and pooled for further processing.
Hot air oven/Autoclave: A hot air oven/autoclave in the milk bank or centralized sterile service department is essential for sterilizing the articles needed in the bank.

Breast milk pumps: For milk banking, hospital grade electric pumps are preferred as they result in better volumes of expressed milks and are relatively painless and comfortable to use.

Containers: For collection and storing the milk, single use hard plastic containers of polycarbonates, pyrex or propylene are used across the world.

Generator/Uninterrupted power supply: Every milk bank should have a dedicated centralized source of uninterrupted power.

Milk analyzer: It is desirable to have macronutrient analysis of breast milk to estimate the calorie, protein and fat of a milk sample.

VI. ADMINISTRATIVE STAFF

It should consist of a Director (for planning, implementing and evaluating the services), Milk bank officer (usually a doctor, for day-to-day running of the bank and training), Lactation management nurses (for counseling mothers and aissisting expression of breastmilk), Milk bank technician (for pasteurization of breastmilk and microbiological surveillance), Milk bank attendant (for collecting, sterilization of the containers and maintaining hygiene), Receptionist (for record keeping and public relations), Microbiologist (for microbiology testing and infection control policies).

VII. COLLECTION OF BREAST MILK

After proper counseling, checking suitability for donation, getting written informed consent, history taking, physical examination and sampling for laboratory tests, the donor is sent to designated breast milk collection area in the milk bank or in the milk collection centre.

VIII. PROCESSING:

1. Refregation
2. Pasteurization
3. Microbiological Screening

IX. BENIFICIARIES:

- All critically infants specially preterm
- Adopted child
- Mother who cannot fed due to any emergency like PPH etc.
- If mother had undergone for LSCS under general anaesthesia,

X. BENIFITS OF BREAST MILK

Antibodies that are in breast milk are not in cow’s milk/formula and cannot be artificially produced. The amount of protein in cow’s milk/formula is double the amount in breast milk and is also a different and less digestible type. Cow’s milk/formula has smaller amounts of carbohydrates than breast milk. The fat in cow’s milk/formula is very different than the fat in breast milk and digestibility is poor. Tetany, late onset metabolic acidosis, milk allergy, iron deficiency anaemia, dental caries, Zn and Copper deficiency are diseases related commonly to the cow’s milk feeding.

XI. DISTRIBUTION: 21

- Milk is transported in ice packs.
- Oldest milk being used first.
- Once milk has been warmed at room temperature, it should be used within 4-6hrs.

XII. FUTURE PERSPECTIVE:

- Developing lyophilizing (dry powder form) human milk.
- Ultrasonic homogenization human milk.

XIII. CONCLUSION

Through Breastfeeding, newborn babies get the immunity, nutrition required for growth and development. If the mother does not have enough breast milk or if she is sick or her milk is grossly vitiated, in that case wet nurse or Dhatri would be required. In some cultures wet nurses were slaves or as today, many are employed allowing mothers freedom to work or pursue a lifestyle choice. In this situation human milk replace with human milk. It is better to employ a wet nurse as no other milk can be compared with mother's milk for proper growth and development of the child. Likely Dhatri, newly developed human milk bank both aims to nutrition newborn babies. So, human milk bank correlated with dhatri, the fundamental of ancient science. Milk banks store breast milk for newborns whose mums can’t breastfeed them. Usually, the banks collect expressed breast milk from pre-screened mums, who have a plentiful milk supply and help the needy child. 24It is clear that artificial formula will never provide the broad range of benifits of human milk. Given the high rate of preterm birth in the country and level of malnutrition that ensues in the postnatal growth in such babies after birth, there is an urgent need for establishing milk banks across the country, especially in the large NICUs of all hospitals.

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AUTHORS

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Strategic Factors Affecting Sustainability of Fiber To The Home (FTTH): Case of Safaricom, Kenya

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Abstract- This study assessed the strategic factors affecting the sustainability of fiber to the home (FTTH), a case of Safaricom Limited, Kenya. FTTH is an access network architecture that extends from telecommunication operator's central office to the customer's premises using the optical fiber connection path terminated in the home to provide communication services. FTTH is a high-speed connectivity and used to provide various services to the customer including but not limited to internet, video on demand, television, voice and security services. The telecommunication operators, however, face various challenges in the provision of FTTH. The service is expensive to deploy and operate. There was, therefore, need to reach many customers and sustain their subscription to the service. It is thus necessary to study the factors that affect the sustainability of the FTTH service. The factors that affect the sustainability of FTTH as conceptualized in this study were partnerships, brand, technological innovations and pricing (independent variables). This study was based on two theoretical foundations namely: Christensen and Raynor's Theory of the Innovator's Solution and; the Theory of the Firm. The study sampled 92 individuals from a total target population 120 using stratified random sampling. Data was collected through the use of structured questionnaires. Descriptive statistics (frequencies, percentages and weighted means) and; inferential statistics (Multiple Regression Analysis and Pearson Correlation) were carried out. The findings obtained show that partnerships enhance service delivery as companies that enter into partnerships bring together their resources such as human, financial and material resources. Regarding brand strategy, it is evident that in most cases, companies that have known brands tend to attract more customers. Furthermore, superior brands tend to lock-in customers as the opportunity cost associated with moving to other companies is usually high. Technological innovations also play key roles in enhancing the sustainability of FTTH service. Evidently, competition in the telecommunications sector meant that businesses had to be at the forefront of technological innovation. Since superior products were always being formulated, the service constantly innovated and improved its services so as to retain their clients. On their part, pricing strategies play a central role in attracting customers. In this regard, Safaricom’s FTTH service had attractive prices. Prices were constantly to match those offered by other companies, an aspect of price differentiation. This made it possible to attract more customers to the service resulting in enhanced sustainability of the service since a big customer base is correlated with sustainability of a service. The following recommendations are made. Regarding partnership strategies, FTTH services should endeavor to have strong partnerships so as to enhance their ability to secure expertise and share resources and reduce operation costs. On brand strategy, Safaricom’s FTTH services should endeavor to extend to as many parts of the country as possible and to make the brand known so as to attract and lock-in more customers in the wake of intense competition in the internet service provision industry. Technological innovations should be enhanced. As such, it was necessary for Safaricom to constantly innovate and improve their services so as to retain their client. Regarding pricing strategy, Safaricom’s FTTH service should have attractive prices. Constant market surveys should be undertaken so as to constantly adjust the prices of the service to the prices offered by other companies, an aspect of price differentiation. Lastly, the study recommends studies targeting other companies should also be carried out as FTTH services continue increasing in the market. This is vital since the information garnered can help strategic managers learn how to best deal with emergent sustainability challenges in offering these services across a wide range of telecommunications companies.

Index Terms- Nairobi City County, Competitive edge, media strategies

I. BACKGROUND OF THE STUDY

Fiber to the home (FTTH) is a fiber optic communications path that extends from an operator’s switching equipment to at least the boundary of a home living space or business office space (Communities, 2015). In this form of internet service; homes are connected directly to the fiber optic from a central point. The premises that have with this type of internet service enjoy unprecedented access to high-speed internet, (Awasthi & Bhadauria, 2014). Due to its high-speed internet connectivity, FTTH offers far more bandwidth, reliability, flexibility, security and longer economic life than alternative technologies, even though its price is comparable, (Communities, 2015)

The rise of the use of optic fiber in the provision of internet access is driven by the demand for high-speed internet. As companies and individuals started demanding high-speed internet, telecommunication operators began looking for avenues for delivering broadband internet services. The need for high bandwidth of information forced telecom operators to renew
copper-based access networks frequently but this was unsustainable hence these companies considered high volume roll-out of the current access networks that based on optical fiber, (Smith, 2006). This demand for high-speed communication path led to the deployment of fiber in or closer home.

Since its inception, FTTH has proven to be an ideal choice of providing the internet because of its broadband capacity. Chardy (2012), points out that if clients are served entirely by the optic-fiber, it is possible to increase the bandwidth in the future. As such, FTTH is a long-term solution to the internet speed and connectivity challenges facing internet service providers. It is also a solution that can last for many years for providing broadband services such as HD TV, VoIP, Online Gaming and, Video in Demand among others.

Kenya’s telecoms operator Safaricom is an adopter provider of FTTH services. Safaricom has 3,236 km fiber network which serves more than 15000 Homes, (Safaricom Ltd, 2016). In 2016, Safaricom signed a Memorandum of Understanding (MoU) with Kenya Power for the launch of a 12-month fiber-optic pilot project aimed at having at least 12,000 homes in Nairobi connected to the FTTH, (Telegeography, 2016). This partnership meant that Safaricom would lease Kenya Power's fiber infrastructure to provide households with last mile internet connections. The state-run Kenya Power had fiber infrastructure that stretches over 4,000 Km and its use would provide Kenyans with faster, reliable and affordable broadband services. The partnership with Kenya Power was hoped to augment this figure to more than 1 billion shillings by the end of 2017.

However, the provision of FTTH service is not without challenges. The service is expensive to run,(Chardy, 2012) and failure to reach anticipated customers would lead to loss to the millions of shillings invested in rolling out the service. The main challenges of deploying FTTH to be Cash flow management, recruiting qualified personnel, scaling the operation of a new network, expanding to new locations or new network topologies and regulatory barriers, (Whitman, 2007). These challenges if not addressed render the service unsustainable. Therefore, and as conceptualized in this study, companies should continually examine the factors that affect the sustainability of the FTTH service. Failure to do this the service may be rendered unsustainable to high initial cost and a high cost of running underutilized installations.

This current study conceptualizes that the deployment and sustainability of fiber to the Safaricom’s FTTH service is affected by partnerships, brand recognition, technological innovations, and pricing. It is hypothesized that the joint effect of these factors determines the level to which the FTTH service is sustainable in the Kenyan market. However, minimal studies have been documented in Kenya for this relationship hence the need for this current study.

**Fiber to the Home on a Global Perspective**

The European Union has seen immense strides in the provision of broadband access to the Internet (Blackman & Srivastava, 2011). The continent has seen extensive fiber optic internet connectivity, usually through state funding. Starting in 2009, the EU issues the guidelines in which billions of Euros were to be used in giving access to high-speed broadband networks and the services to EU citizens and companies

In New Zealand and Australia, Gómez-Barroso and Feijóo (2012), posit that fiber optic internet has increasingly become available to citizens. The come about following massive privatization and established of publicly owned companies tasked with building fiber networks that reach local areas. As a result, the two countries have total turn-around after these efforts.

In Japan, Biggs and Kelly (2006) point out that increase in demand for cheap internet had pushed public and private companies to invest highly in local IP networks and fiber-optic access networks. In the last decade, several Japanese have chosen FTTH in the bid to increase the reliability of voice, video, and data as a speed of internet connectivity is over 100mbit/s in the fiber to the home network.

**Fiber to the Home on a Regional Perspective**

According to Mulas (2012), broadband is growing faster in the developing world, including Africa, with a compound average growth rate of over 200% since 2009 as compared. However, ITU (2012b) reports that fixed broadband penetration in Africa remained very low with an estimated penetration of only 0.2% by the end of 2011 which shows that is still a substantial untapped FTTH market in the continent.

Kim, Kelly, and Raja (2010) point out that in developing countries; the broadband internet is linked to economic growth. In this regard, for every 10% increase in broadband penetration, there would be a 1.38% increase in the economic growth. This situation has pushed countries in the region to increasingly adopt FTTH services in the bid to spur economic growth and increase employment opportunities for their citizens.

In corroborations with the findings of Kim et al. (2010), Katz (2012) asserts that increasing broadband services penetration in African counties by 1% could contribute an additional 0.0158% to the GDP growth. These findings have driven many African countries to partner with development partners as well as international telecommunication companies to enhance the access to the broadband internet through FTTH services among others.

Stork, Calandro, and Gamage (2014) point out that in South Africa, accessibility to FTTH as well as other broadband services has grown extensively. In the last decade, the country has remained in the top 100 countries that use broadband internet globally. This finding shows that there is a positive reception of FTTH in African countries.

**Fiber to the Home on Local Perspective**

Optic fiber has increasingly taken center stage in Kenya. According to Ochola (2013), the arrival of three fiber-optic international submarine cables namely SEACOM, EASSY, and TEAMS in 2009 and 2010 open doors for broadband communication in Kenya. The landing of the undersea cables ended the dependency on limited and expensive satellite bandwidth in the country.

Wakukha (2011) is of the view that internet users in Kenya have increased immensely since 2011. Out of the more than estimated 10.2 million in 2011, an increasingly significant number has increased due to the emergence of the fiber optic network which offers fast internet connections. According to Stork et al. (2012), internet connections to Kenya are still low. As at 2011, these stood at 12.7% in 2011.

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www.ijsrp.org
The Kenya Power Fibre Optic Network (Kenya Power, 2017) has had a Network Facility Provider license from the Communications Commission of Kenya (CCK). The optic fiber by the firm dubbed "U-Telco" is aimed at increasing the ability of the country to meet the increasing bandwidth demand for voice, data, and video. Safaricom limited, Jamii telecommunications limited, Wananchi group through Zuku and Telkom Kenya are companies currently offering FTTH services in kenya. As such, a lot of effort is being made to increase the accessibility of internet in the country.

II. STATEMENT OF THE PROBLEM

FTTH as an internet installation gives promises unprecedented access to high-speed internet, (Awasthi & Bhadauria, 2014). Due to the high-speed internet connectivity promised by the FTTH service, its popularity has been on the rise the world over. But its provision is not without challenges. The service is expensive to run, (Chardy, 2012) and failure to reach anticipated customers would lead to loss to the millions of shillings invested in rolling out the service. It is this necessary to study the factors that affect the sustainability of the FTTH service.

Various studies such as Gubbins (2015), have attempted to study the effect of partnerships on the sustainability of projects. However, none of these studies focus on Safaricom's FTTH project. The study of Arslan and Altuna (2010), shows how branding affects the sustainability of a service or product but does not focus on Kenya or an African country for that matter. Regarding technological innovations, various studies were reviewed. These include studies such as Rubera and Kirca (2012), but none of these studies focused on Kenya or an African country. The findings obtained may thus not relate to innovations in the FTTH in Kenya. Pricing is also an important factor affecting the sustainability of projects the world over. Various studies, such as Mulaa (2014) and Mokaya et al. (2012), show that affordable prices enhance the sustainability of a service. The main challenges of deploying FTTH to be Cash flow management, recruiting qualified personnel, scaling the operation of a new network, expanding to new locations or new network topologies and regulatory barriers, (Whitman, 2007). These challenges if not addressed render the service unsustainable

III. SPECIFIC OBJECTIVES

The specific objectives of the study were:
1) To assess how partnership strategy affect sustainability of fiber to the home (FTTH)
2) To determine how brand strategy affect sustainability of Fiber to the home (FTTH)

IV. CONCEPTUAL FRAMEWORK

<table>
<thead>
<tr>
<th>Partnership Strategy</th>
<th>Sustainability of FTTH Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kind of partnerships</td>
<td>Timely Implementation</td>
</tr>
<tr>
<td>Value of Partnership</td>
<td>Financial Efficiency</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brand Strategy</th>
<th>Dependent Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognition</td>
<td></td>
</tr>
<tr>
<td>Market Share</td>
<td></td>
</tr>
<tr>
<td>funded</td>
<td></td>
</tr>
</tbody>
</table>

V. RESEARCH METHODOLOGY

This chapter presents the research method used in this study. It contains sections on the sample, sampling techniques, data collection instruments, data analysis and methods of presenting the findings obtained.

Research Design

Kothari (2009) is the view that a research design is the arrangement of conditions for collection and analysis of data. This is done in such a way that the procedure has relevance to the research purpose and is economical. This study used the descriptive survey design. Descriptive surveys are used to describe the relationship between the variables under investigation in a study (Best & Kahn, 1989). The essence of this design is that it shows the study subject on “as it is” basis. As such, and in assessing the strategic factors affecting the sustainability of fiber to the home (FTTH), it was identified as a suitable design. This is more so because it shows the relationship between ‘strategic factors’ and ‘sustainability’ of Safaricom’s FTTH service.

The Target Population

The population of a study is an amalgamation of the entire groups of individuals or objects which possess common characteristics within a particular space and at a specific period (Mugenda & Mugenda, 2003). This study targeted employees of Safaricom Limited working at the headquarters in Nairobi City County. The choice of Safaricom Limited is informed by the fact that it’s the leading telecommunication sector, with an extensive FTTH service. However, no documented study has attempted to unearth the strategic factors affecting the sustainability of FTTH services in Kenya. The population for this study comprised of managerial and middle-level staff drawn from 6 departments of Safaricom namely: the Strategy and Innovation; Technical and IT; Regional Sales and Operations; Customer Operations; Consumer Business Unit and; Corporate Affairs. Herein, 20 employees per department (4 managerial and 16 middle-level staff) were targeted. This made the total target population 120.

Employees from these departments Sampling Frame

A sampling frame is a list of all items as well as individuals from a population who can be sampled in a particular study (Best & Kahn, 1989). The sampling frame for this study consisted of the managerial and middle-level staff drawn from the departments of Strategy and Innovation; Technical and IT; Regional Sales and Operations; Customer Operations; Consumer Business Unit and; Corporate Affairs.

<table>
<thead>
<tr>
<th>Department</th>
<th>Management Staff</th>
<th>Middle-Level Staff</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy and Innovation</td>
<td>4</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Technical and IT</td>
<td>4</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Regional Sales &amp; Operations</td>
<td>4</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Customer Operations</td>
<td>4</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 3.1: Sampling Frame

The Target Population:

<table>
<thead>
<tr>
<th>Department</th>
<th>Target Population</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managerial Staff</td>
<td>24</td>
<td>18</td>
</tr>
<tr>
<td>Middle-Level Staff</td>
<td>96</td>
<td>74</td>
</tr>
<tr>
<td>Total</td>
<td>120</td>
<td>92</td>
</tr>
</tbody>
</table>

* Formula applies to the total formula. The strata sample sizes are proportionately allocated from the derived total

Sample and Sampling Techniques

Sampling is the process through which some individuals that contains the elements representative of the entire group is selected from a population (Mugenda & Mugenda, 2003). In most cases, studies are carried out on samples. There are numerous sampling techniques. A sampling technique regards the specific process by which a sample is selected (Cooper & Schindler, 2013). This study used stratified random sampling. In this form of sampling, the study population is divided into homogeneous groups (strata). After that, samples are obtained from each stratum (Best & Kahn, 1989). In this study, the stratum included directors and departmental heads.

The study used the simplified formula that designed by Yamane (1967) and expounded by Cooper and Schindler (2013) to calculate sample size from each stratum. The formula employed is:

\[ n = \frac{N}{1 + N (e)^2} \]

Where:

- \( n \) = sample size,
- \( N \) = population size and
- \( e \) = the level of precision (0.05).

As such, the 92 individuals were sampled in this study.

Table 3.2: Sample Size

Data Collection Instruments

According to Cooper and Schindler (2003), data collection tools are generic structured forms used for collecting and analyzing data. Data was gathered through the use of structured questionnaires. The questionnaire was chosen for this study because it is practical as it assures the data collection from a large number of people within a short time in a relatively cost-effective manner, and is free from the bias of the interviewer (Kothari, 2004). The questionnaire was based on the study objectives. Herein, questions were formulated based on these objectives. A section was included in the questionnaire on general information, each of the four independent variables and one section for the dependent variable. The questionnaires contained closed-ended questions.
The population of 12 was guided by Kasomo (2007) who selected for the pilot study did not participate in the final study. The persons selected for the pilot study did not take part in the final study. The population of 12 was guided by Kasomo (2007) who postulated that 10% of the target population is sufficient for pre-testing of questionnaires in descriptive studies. As such, the formula for arriving at the pilot study sample was as follows:

\[ n_p = N \times 10\% \]

\[ n_p = 120 \times 10 \]

\[ n_p = 12 \]

Where:

- \( N \) = target population
- \( n_p \) = Pilot study sample

**Validity of the Research Instrument**

Validity is the degree to which a test or an instrument measures what it is supposed to measure (Mugenda & Mugenda, 2003). Validity is vital since it enhances appropriate interpretation of the attitudes and opinions of the respondent. In this study, data collected from the pilot test was used to test the validity of the research instrument. In this regard, the instrument checked for accuracy, clarity and suitability. The ability of the respondents to answer the study questions with without problems was also assessed and improvements made on the research instrument. Also, the instruments were presented to the supervisors for their expert advice. Their input was used to enhance the questionnaire further.

**Reliability of the Research Instrument**

According to Mugenda and Mugenda (2003), reliability is used to measure the degree to which a research instrument yields consistent results after repeated trials. The data obtained from the pilot study was tested using Cronbach’s alpha to gauge its reliability. The Cronbach’s alpha is a reliability coefficient that measures the degree of internal consistency/homogeneity between variables measuring the same construct. In this test, a value of 0.6 or less indicates poor internal consistency reliability while acceptable reliability estimates range from 0.70 to 0.80 (Malhotra, 2004).

The data collected was entered and verified after coding. After that, it was examined concerning the objectives of the study. Several statistical tests were undertaken using the Statistical Package for the Social Sciences (SPSS) version 24. These included descriptive statistics such as frequencies, percentages and weighted means; inferential statistics such as Multiple Regression Analysis and Pearson Correlation).

The following regression model that was adopted by the study:

\[ Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \epsilon \]

Where: \( Y \) = Implementation of Sustainability of FTTH

\( \beta_0, \beta_1, \beta_2, \beta_3, \) and \( \beta_4 = \) Sustainability of FTTH

\( X_1 = \) Partnerships

\( X_2 = \) Brand

\( X_3 = \) Technological Innovation

\( X_4 = \) Pricing

\( \epsilon = \) Error term

On its part, data from open-ended questions were analyzed thematically in line with the study objectives. The emergent significance of the findings obtained in line with the study objectives was assessed. Thereafter discussions were then made against the literature reviewed.

**Data Presentation**

The results obtained were presented in tables, charts and graphs. These were used since they summarize and display information in a manner that is easy to understand and analyze (Kothari, 2004). After that, the findings obtained were discussed against the literature reviewed and appropriate conclusions made.

**VI. RESEARCH FINDINGS AND DISCUSSION**

In this chapter, the findings of the study are presented. Data was collected from managerial and middle-level staff drawn from the departments of Strategy and Innovation; Technical and IT; Regional Sales and Operations; Customer Operations; Consumer Business Unit and; Corporate Affairs of Safaricom Limited. Herein, 92 individuals had been sampled using stratified random sampling.

**Response Rate**

From the 92 questionnaires issued to the respondents, 88 were handed back reflect a response rate of 95.7% which was deemed sufficient for data analysis.

**Results of the Pilot Study**

Before administration, the questionnaire was pretested through a pilot study targeting 12 individuals drawn from the departments under investigation in Safaricom. The persons selected for the pilot study did not participate in the final study. The population of 12 was guided by Kasomo (2007) who postulated that 10% of the target population is sufficient for pre-testing of questionnaires in descriptive studies.

On its part, the validity of the questionnaire was assessed by finding out the ability of respondents to answer the questionnaire with ease. The findings obtained show that the

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respondents were able to respond to the study questions presented to them without any difficulties. As such, the questionnaire was deemed fit for use in data collection.

Conversely, Cronbach’s alphas was used in testing the reliability of the research instrument. The findings obtained are presented in Table 4.1

Table 4.1: Reliability Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partnership Strategy</td>
<td>0.773</td>
</tr>
<tr>
<td>Brand Strategy</td>
<td>0.831</td>
</tr>
<tr>
<td>Technological Innovation</td>
<td>0.815</td>
</tr>
<tr>
<td>Pricing Strategy</td>
<td>0.912</td>
</tr>
<tr>
<td>Sustainability of FTTH Services</td>
<td>0.812</td>
</tr>
</tbody>
</table>

For the five variables, the coefficients obtained ranged from 0.773 to 0.912. According to Malhotra (2004), coefficients ranging between 0.7 and 0.8 are considered acceptable; those ranging between 0.8 and 0.9 good; those greater than 0.9 excellent. Owing to the high values of the coefficients obtained in this study, the questionnaire was deemed reliable for use in data collection.

General Information of the Respondents

General information about the work position of the respondents was investigated. The findings obtained show that all the departments were well represented. The majority of the respondents (19.3%) came from the Strategy and Innovation department. These were followed by those from Customer Operations and Consumer Business Unit departments each at 17%. The next was from the Technical and IT and, Regional Sales and Operations departments each at 15.9%. The least were those from the Corporate Affairs department (14.8%). From these findings, it is evident that all the divisions were represented sufficiently in the study. This representation reduced bias since the views of employees from various departments were obtained. The findings obtained are presented in Figure 4.1.

Descriptive Statistics

The researcher posed numerous Likert-type statements to the respondents. These were in line with study variables. The responses were captured on a scale of 5 to 1 where: 5=to a very great extent; 4=to a great extent; 3= to a moderate extent; 2=to a limited extent and; 1=Not at all. After that, the weighted means obtained were used to show the central tendency (average attitude of the respondents) on the statements presented to them. In the end, the findings were analyzed against the reviewed literature.

Partnership Strategy

The study aimed at assessing how partnership strategy affects the sustainability of fiber to the home (FTTH). Data was captured in 5 Likert-type questions as well as an open-ended question.

Findings from Likert-Type Questions

Table 4.2 below presents the data collected from the five Likert-type scale statements. The findings in Table 4.2 show that weighted means ranging from 4.61 to 4.88 were obtained showing the respondents tended to agree with statements presented to them to a very great extent. As such, it is apparent that partnerships are indispensable since they enhance the success of FTTH services through sharing resources and expertise. This finding agrees with Cetindamar et al. (2010) who argue that partnerships help in sharing and recruiting experts, carrying out collaborative development with partners and in
some instances purchasing the businesses that have rights to exploit the technology.

The findings also show that partnerships enable collaborative arrangement that affects the sustainability of FTTH projects, also in corroboration of the findings of Cetindamar et al. (2010). It was also agreed to a very great extent that partnerships enhance innovativeness in ventures such as internet provision where various actors bring their strengths to reach new markets better and; that Safaricom can achieve more by involving industry partners to support the internal development of FTTH outreach capabilities. The finding agrees with Gubbins (2015) who argues that increased customer reach through the resultant agency networks in partnerships increases the accessibility of the services of such partners in the industry.

Lastly, the findings show that FTTH services help in developing tailor-made solutions and that this reduces costs and risks. It can thus be deduced that partnerships enhance better reach to customers through superior services, therefore, enhancing the sustainability of a service.

Table 4.2: Agreement to statement on effect of Partnership Strategy on sustainability of FTTH Services

<table>
<thead>
<tr>
<th>Measurement statement</th>
<th>N</th>
<th>Weighted Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partnerships are indispensable since they enhance the success of FTTH services through sharing resources and expertise</td>
<td>88</td>
<td>4.88</td>
<td>0.33</td>
</tr>
<tr>
<td>Partnerships enable collaborative arrangement that affects sustainability of FTTH projects</td>
<td>88</td>
<td>4.82</td>
<td>0.39</td>
</tr>
<tr>
<td>Partnerships enhance innovativeness in ventures such as internet provision where various actors bring their strengths to reach new markets better</td>
<td>88</td>
<td>4.80</td>
<td>0.43</td>
</tr>
<tr>
<td>Safaricom can achieve more by involving industry partners to support the internal development of FTTH outreach capabilities</td>
<td>88</td>
<td>4.68</td>
<td>0.69</td>
</tr>
<tr>
<td>Partnership in the FTTH services helps in developing tailor-made solutions and reduces costs and risks</td>
<td>88</td>
<td>4.61</td>
<td>0.83</td>
</tr>
<tr>
<td><strong>Average Weighted Mean</strong></td>
<td></td>
<td><strong>4.76</strong></td>
<td></td>
</tr>
</tbody>
</table>

Findings from Open-Ended Question

The respondents were presented with the question: In which other ways do partnership strategies enhance the sustainability of FTTH services? The findings obtained show that partnerships enhance service delivery as companies that enter into partnerships bring together their resources, as argued by Gubbins (2015). In this accord, various human, financial and material resources are brought together to enhance the provision of services. Moreover, expertise is easily outsourced, and this enhances the sustainability of the FTTH service as elicited by Pattberg et al. (2012).

Brand Strategy

The study aimed at assessing how brand strategies affect the sustainability of fiber to the home (FTTH). Data was captured in 5 Likert-type questions as well as an open-ended question.

Findings from Likert-Type Questions

Table 4.3 below represents data collected from the five Likert-type scale statements. The weighted means of the data obtained ranged between 4.74 and 5.00. The survey showed general tendency to agree to the statements to a very great extent. In this regard, it was made manifest that a recognizable FTTH brand which fulfills the needs of customers is likely to beat its competitors in the market, and this can enhance its position in the market for long periods of time. This finding agrees with Arslan and Altuna (2010) who argues that brands that have high awareness are characterized by high customer loyalty, high-profit margins and an increased competitive edge among others. Furthermore, brands that are recognizable have a competitive advantage over brands that are less known in the market and that Safaricom’s FTTH brand recognition enhances its sustainability in the Kenyan market. These findings are in line with Petter (2009) who argues that recognized brands can easily position themselves in new markets and that once known brands overcome market challenges, and they gain a capacity that is hard to overcome by new entrants in the market. The brand recognition gives them long-term sustainability as newer entrants try to overcome bottlenecks in the market (Petter, 2009). Lastly, the findings obtained show (agreement to a very high extent) that Safaricom’s FTTH brand has high awareness and is characterized.
by high customer loyalty and that; Safaricom’s FTTH brand has high awareness, many customers and high-profit margins (Arslan & Altuna, 2010).

Table 4.3: Agreements to statement on the effect of Brand Strategy on sustainability of FTTH services

<table>
<thead>
<tr>
<th>Measurement Statement</th>
<th>N</th>
<th>Weighted Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A recognizable FTTH brand which fulfills the needs of customers is likely to beat its competitors in the market, and this can enhance its position in the market for long periods of time</td>
<td>88</td>
<td>5.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Brands that are recognizable have a competitive advantage over brands that are less known in the market</td>
<td>88</td>
<td>4.94</td>
<td>0.23</td>
</tr>
<tr>
<td>Safaricom’s FTTH brand recognition enhances its sustainability in the Kenyan market.</td>
<td>88</td>
<td>4.99</td>
<td>0.11</td>
</tr>
<tr>
<td>Safaricom’s FTTH brand has high awareness and is characterized by high customer loyalty</td>
<td>88</td>
<td>4.85</td>
<td>0.39</td>
</tr>
<tr>
<td>Safaricom's FTTH brand has high awareness, many customers, and high-profit margins</td>
<td>88</td>
<td>4.74</td>
<td>0.49</td>
</tr>
<tr>
<td><strong>Average Weighted Mean</strong></td>
<td><strong>4.90</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Findings from Open-Ended Question

Furthermore, the respondents were presented with the question: *In which other ways does brand strategy enhance the sustainability of FTTH services?* The findings obtained show that in most cases, companies that have known brands tend to attract more customers, a finding that is in line with Lee (2008) who is of the view that recognized brands tend to have large customer bases.

Furthermore, preferred brands tend to lock-in customers like the opportunity cost associated with moving to other companies is usually high. As such, Safaricom's FTTH services should endeavor to extend to as many parts of the country as possible and to make the brand known to attract and lock-in more customers in the wake of intense competition in the internet service provision industry.

VII. CONCLUSION

Based on the study findings, various conclusions can be made. The findings obtained show that partnerships enhance service delivery as companies that enter into partnerships bring together their resources. In this accord, various human, financial and material resources are brought together to strengthen the provision of services. Moreover, expertise is easily outsourced, and this enhances the sustainability of the FTTH service. Regarding brand strategy, it is evident that in most cases, companies that have known brands tend to attract more customers. Furthermore, preferred brands tend to lock-in customers like the opportunity cost associated with moving to other companies is usually high.

VIII. RECOMMENDATIONS

The following recommendations, which are based on the study findings, are made. The recommendations were presented in line with the study variables.

### Partnership Strategy

Regarding partnership strategies, FTTH services should endeavor to have strong partnerships to enhance their ability to secure expertise and share resources. This is vital since it can reduce operation costs, making the service sustainable. Constant review of the existent partnerships should be done so that new partners could be attracted to strengthen the provision of FTTH services.

### Brand Strategy

On brand strategy, it is evident that in most cases, companies that have known brands tend to attract more customers. As such, Safaricom’s FTTH services should endeavor to extend to as many parts of the country as possible and to make the brand known so as to attract and lock-in more customers in the wake of intense competition in the internet service provision industry.

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Occurrences of Clean Water Problems in Africa

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Abstract- From 1990 to date, Africa has seen great progress in terms of the provision of safe and quality water to its populace. The inadequacy of this important (water) resource in the continent affects not only the health of populace but also the development of the area, especially in industrial, urban and agricultural sectors. The African continent is the underdeveloped in terms of the use of modern technologies for water treatment in all its forms. Protection and management of the effects of climate change is hindering the management of this water resource as well. Factors that affect the quality of water on the African continent should be addressed by all stakeholders. This in effect, would provide lasting solutions to the menace in order to enable the continent which is full of other natural resources to realize its full potentials in modern technology.

Index Terms- African Continent, Water pollution, Drinking water, Resources, Technology

I. INTRODUCTION

Large population around the world does not have enough water to sustain their livelihoods. More than 1.1 billion people in the world are affected by water scarcity or lack of safe drinking water, meaning that one in every six people lacks access to safe drinking water. Inadequate access to water is a sign of poverty and it affects people’s basic needs, health, food security, and livelihoods. Africa, the second largest continent, with 55 countries with about 30,221,532km² area [1], which is about 20.4% of the Earth’s land area [2]. With about 1.033 billion people [3], it is the second-most populous continent, accounting for 15% of the world’s human population [4]. It’s no wonder that this population makes Africa experience water problem. The biggest problem is the inability to find clean, adequate water for drinking anytime. Most people in Africa depend on surface water and don’t have the technology or the necessary finances for the traditional methods of water use. As we know about African continent climatic conditions are arid in some regions, surface water evaporates often, and this has placed a strain on the water bodies by a large population which proves the lack of groundwater in Africa continent.

Between dirty water and no water at all which one is better? Lacking water has enormous consequences on individuals and communities. The population needs water to survive, do not have it or in insufficient quantity, will cause them to be in a dangerous state, threats or dehydrates. Even if we have abundant water but polluted, at first sight it is as, we do not have any because it cannot be used, but it seems better than not having any at all. Of this polluted water a new challenge begins, that of the treaty, to make it clean water to serve for ends.

II. WATER SITUATION IN AFRICA

The Millennium Development Goal on sustainable access to drinking water was reached in 2010. The objective of ensuring that 88% of the world’s population has a reliable supply of safe water. However, the objective of drinking water has not been reached by the continent, only 20% improvement in access to clean water has been noted. In the style of lives of African countries, the rich people in urban city are more privilege to quality and safe drinking water than rural residents. It is sad to note that, a large part of African population still continue to use improper source of drinking water. Sanitation: Halve the proportion of the population without sanitation between 1990 and 2015[5]

The sanitation issues condition the quality of the water that we have from various sources, even if today noticeable improvement is felt, many disadvantaged areas with difficult access near water source increases the risk of water pollution. The populace’s good hygiene manners should be practical point to attain access to improved sanitation for the Africans. Some of usual bad practices such as: open defecation, the deposit of garbage in the environment without any precaution should be a significant challenge to solve. It is true that sanitation situation in rural Africa area and using adequate clean water has critical view in the past than today [6], but others aspects like the lack of communication, research, publications that the continent suffers to cope with the ills it has. Also not only there is difficult access to clean water, even if water is available, there are some risks of contamination due to many factors. Sometimes, the groundwater use technic requires a lot of developed water sanitation facilities, according to the limited financial resources, the maintenance of these technic is poorly managed. Examination of water quality is not done as it should be, and inexistence of education among for people who are using water leads them think that as long as they can receive water from a well, it is no mater. Usually, after building a well for people demand, the population makes more attention for quantity of water than quality of this water used [7]. Of this large expanse of water in the African continent, few of them are available to be a good source of water for consumption. Rainwater sources are usually polluted, and adequate hydraulic work to drive water from clean sources to areas in need is too

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expensive Groundwater is adequate resource to provide clean water to all the areas in Africa, especially in disadvantaged areas to avoid costly installations of the usual treatment systems, and this has the advantages of being naturally saved from bacterial pollution. However, Africa's limited technical capacity to secure natural water resources must prioritize public awareness. It is noted in some localities that water from sources close to the population is sometimes boiled or added some of the pharmaceutical products for domestic purposes. This archaic practice embodies a lack of knowledge of the risks of contamination and infections. Groundwater is not a good water resource guarantee, either, when it comes to giving clean water. Water pollution is caused by heavy metals, bacteria, and others, they contaminate not only the water sources but also the environment, which entrains the death of fish and the destruction of vegetation. In that case, it would be nice to protect groundwater be monitored frequently, which is expensive and requires a technical approach that most of the times are not present in rural areas [7].

Developed areas are confronted with different challenges to procure clean water and sanitation. The necessary control of the overcrowding in urban cities requires to ensure the quality in additional water supply source, the human waste generate in these agglomerations, are all factors that the continent should face to improve, their wastewater management systems. Because, these factors can create the pollution of natural water bodies, the dirty water use in irrigated agriculture, usual water supply, and environmental concerns for aquatic life due to the high concentration of pollutants into water bodies [8].

Access to water
African countries have seen various evolution towards the Millennium Development Goal on water although on the same continent. North Africa has 92% coverage and was on track to meet its 94% target before 2015. However, 40% of the 783 million of Sub-Saharan Africa population experiences show that they live without access to an improved source of safe water from their area. Although the sources of drinking water are limited in Africa, the budget for the total coverage of this water is another problem, it is true that it requires great processing technology and precise techniques, but the continent must refer to his own realities while drawing inspiration from developed countries. Sub-Saharan Africa was behind on the objectives from the MDG meeting on water with just 61% water coverage for the population demand and with the non-resolution of this slow pace did not reach the 75% target set for the locality [9]. Research of 35 countries in Africa shows significant differences between the poorest and richest fifths of the population in both areas (rural and urban areas). The access to improved water sources is only possible for Over 90% of the richest people in urban cities, and most of them have piped water in their houses. Piped-in water was non-existent in 40% of poorest households in rural areas, and less than half of the population use all kind of dirty source of water in Figure 1 [9].

Access to sanitation
Africa regions had the least improvement in progressing the MDG on sanitation. Although North Africa had a coverage of 90%, sub-Saharan Africa covers only 30% with an increase of 4% compared to 1990 in Figure 2. Cause of largest of human health and environment pollution due to basic unhealthy sanitation like wastewater disposal, open defecation, poor management of solid waste, and all these issues become a serious concern for the African government. The common practice of open defecation would be the important cause of fecal-oral transmission of disease with children being the most concern.

Although efforts and approaches are being made to provide a good quality of drinking water to the population in Africa, sanitation and hygiene systems led to various health complications, the spread of microbes by causing death within the localities [11]. For some of part in Africa (West/Central Africa), the clean water and sanitation situation need special urgency, as these localities have the biggest under-five mortality rate of all developing regions. Recurrent illness of cholera in both urban and rural areas underlines the poverty of this locality’s basic living condition. The question of sanitation should not be about poverty but rather about education and how African population organizes his solid waste. Before it becomes an important issue, a concern of government for the protection of water sources, it should be the subject of daily habits.
continent needs more than ever contributions and experiences of other developed countries.

III. REASONS OF WATER POLLUTION IN AFRICA

In African countries, there are many reasons analyzed behind the widespread of water pollution, come from people waste management to the industrial dumping in Figure 3.

Figure 3: Different reasons of water pollution in Africa

**Mining:** African continent’s potential of producing many of the most precious minerals, has an advantage over other continents in the world. Although these benefits the respective African countries, the extraction process of these resources has seriously led to a poor quality of water source, because of the mismanagement of the process causes harmful substances to be observed in the water source. Thereby increasing the water pH and murkiness because of the mineral and salt present in the extractives making drinking water becoming unfit for human consumption.

**Agriculture:** Middle-income and emerging economy countries in Africa, agricultural pollution dominates contamination of water bodies compared pollution generated from settlements and industries. In general most of the chemical contaminant in the world’s groundwater aquifers is nitrate from agriculture [12]. Most African economies rely on agriculture this explains hence the highest contributor to water pollution in the continent. Overgrazing, bush clearing and plowing of soil, etc. has resulted in soil erosion. The economy of African countries is mostly based on agriculture for the majority not yet mechanized and often not far from water sources. This approximation to the water sources that sometimes facilitates irrigation causes contamination of the soil, water sources during rainfalls. Besides, the use of excreta and fertilizers in the agriculture production leads to vast amounts of phosphate and nitrates in water bodies. The pesticides on the other hand used in the farms also get carried into water bodies by surface runoff of the non-point source of pollution.

**Deforestation:** This phenomenon is being experienced in the world. However, deforestation is more rampant in African countries as they open more land for farming, settlement especially urbanization and charcoal burning. Giving more explanation, deforestation is the process through which forests are cleared or destroyed without being replaced (Reforestation). This practice has caused negative environmental impacts, such as soil infertility which led to fertilization of soil using chemicals hence pollution of water through surface runoff. Noted also, Africa is one of the world's leading timber exporters, increasing the deforestation phenomenon and exposing the continent to the consequences of climate change.

**Urbanization:** Overpopulation in urban areas complicates even more control disease outbreaks to ensure environment sanitation. The exposure to wastewater is noted that the less affluent population pays more water consumption than the rich, while rich urban areas are highly subsidized, that means the rich peoples are charged less for cleaner water [13]. Every year many people are moving from village to urban city. Normally, before 2030 Africa urbanization rate is predicted to attend the 50% mark. Even if this statistic of progress should be good news for African countries, it is worth pointing out that it also contributes to water pollution. Wastewater treatment might also become a problem as the urban population grows.

**The Rise of Industries:** Where waterborne sewerage systems are used to dispose of human excreta, the system tends to be used also for disposal of industrial waste, especially liquid discharges. Municipal sewage sludge may contain high concentrations of heavy metals, such as cadmium, lead, and chromium. Poisons in industrial discharges can quickly exceed the safety limit: levels about 10 or 20 times higher than those of municipal waste only [14]. Disposal of industrial waste by incineration or land-fill may also contaminate water sources if the waste filters into groundwater or drains to rivers. Heavy metals eventually accumulate in filter-feeding shellfish and plants.

**Poor Sanitation:** The waste treatment is the most important issue for most African countries, they do not have adequate technology to treat their wastes. Most of the households collect their waste to clog stagnant streams in alleys, which is driven by runoff water to public piping, to end up in water sources. Despite this unhealthy practice and non-coverage of proper water in those regions, these waters exposed to pests, bacteria, and other pollutants are used by populations. They also used it for other needs adding some pharmaceutical products this leads to loss human life.

**Politics:** Politics also plays a greater role in water problems in Africa. There are often many water sources that are shared by many countries. This has led to some conflicts, for example when one country has the dam construction project on a shared river. All decisions taken by African countries in sharing a source of water must be subject to co-management, in order to take into consideration all parameters of its security.

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IV. EFFECTS OF WATER POLLUTION IN AFRICA

The implications of inadequate clean water and access to adequate sanitation are widespread. Young children die from dehydration and malnutrition, results of suffering from diarrheal illnesses that could be avoided by clean water and good hygiene [15]. Disease such as cholera is spread rampantly during the wet season. Women and young girls, who are the main role-players in accessing and carrying water, are prevented from doing income-generating work or attending school, as the majority of their day is often spent walking miles for their daily water needs. They are also at an increased risk for violence since they travel such great distances from their villages on a daily basis, and are even at risk when they must go to the edge of the village to find a private place to relieve themselves. Various adverse effects come from water pollution which African continent suffers, such as:

Limited Access to Clean Water

In general, streams that are close to residents, industries, fields of plantations or farms are more polluted by human activities. This means that there is the presence of chemicals products or other toxic substances into both ground and surface water that makes water consumable.

In other words, water pollution makes it unsafe for human use. With the increased rate of Africa population, without available clean water, water issue causes more damage we can think.

Agricultural and Food Supply

When the polluted water runs through farmlands, the soil will become contaminated with harmful toxins that will affect the growth of plants already in the farms and those yet to be planted. Deforestation and urbanization also cause soil erosion which carries away the top fertile soil layers, stripping the soil of the essential nutrients needed by plants to grow. Above all, lack of sufficient water will make it impossible for plants to grow, and in most cases, they’ll eventually dry out. Considering that agriculture is the backbone for most of the Africans countries. The effect of water pollution on farmland will cut short their food supply and leave many of them starving.

Health Effects

The African population as we know despite its increase, is decimated by a high mortality rate, especially the layer of children and adolescents. Lack of good hygiene, the unclean practices associated lack of sanitary infrastructure for needs, are the causes of most of the diseases in the continent. We are going to list the most common water-related infections in Africa:

Cholera: Cholera with his devastating effects: leg cramps, vomiting, and diarrhea, this causes dehydration effect within a short time on those that it affects. The ability to finish with cholera disease is still far from achievement in the continent, but notable progress has been observed in the Africans leaders actions to eradicate this evil that kills the youth of the future of the continent.

Dengue Fever: With effects like high fever, headaches, rashes, and pain, it is not as devastating as the previous. This fever is caused by mosquitos sting. Even not presenting enough cases of death, it leaves complications that affect the liver.

Hepatitis: It is a treatable disease especially with medical progress, but some of the African localities where water pollution is high, have difficult access to health care. It causes one to lose weight significantly, suffers from a lot of discomfort and pain and leads to fever. It is also known to cause diarrhea.

Parasites: Parasites that exist in water which is untreated are known to be many. Water laying around in not well-sanitized conditions can be the habitat for parasites such as ringworm, scabies, and hookworm among others. If a person is exposed for a long time to these water sources or drinking from them regularly, they fall at risk of getting sick. Livestock also falls at risk of being infected as well, and they may pass on the parasites to people who eat the meat from them.

Malaria: Malaria is one of the biggest health challenges that Africa is facing. It is spread by the mosquitos that breed in the many dirty water pools. Swamps are one of them. Malaria is known to affect all, but the ones who are at most risk are children below five years as well as the pregnant mothers. They don’t have the strong immunity to fight the disease. Shocking statistics on Water Situation in Africa.

Facts of the Water Situation in the African Continent:

- Out of the 55 counties in Africa, 14 of them experience severe water shortage issue, and 11 more are expected to have the same experience in a few years to come. In simpler terms, it means that nearly 50% of the continent’s population will be facing limited access to clean water.
- In this continent, a total of 650 people lose their lives every day due to diarrhea that’s water related. Most of the victims are pregnant women and underage children.
- In most of the African countries, you’d be surprised to find out that an average person consumes around 2.6–5.2 gallons of water in a day. This is unlike the 158 gallons consumed by an average person in developed countries like the US. This is to mean that Africa doesn’t always wash their hands, food or clothes to save the water for drinking/cooking. This might be a good source of poor hygiene infection across the continent.
- Out of all the rivers and lakes in Africa (Africa is home to 677 lakes btw), 80 are shared by more 1-2 or more countries. This often leads to political stress, where the parties interested to keep conflicting over the ownership/usage of the resources. And this makes the states unable to keep the water clean or readily available to its citizens.
- Of the entire (huge) population residing in sub-Saharan Africa, only 16% enjoy access to clean water through the dedicated taps in their homes and yards. Part of the remaining population relies on community wells while the others gather the surface water from the nearby sources. Keeping in mind that this water isn’t clean/filtered and might easily pose health risks to the entire population that relies on it.
- One of the biggest problems facing Africa right now is lack of access to clean water that’s safe for drinking/cooking. This comes from the fact that most of the continent’s water is getting contaminated by various human activities—like mining.

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urbanization, deforestation, industrial dumping, poor sanitation, agriculture, and even politics.

V. RESEARCH APPROACHES OF SOLUTIONS

Based on the above analysis, we propose approaches of solutions to preserve and maintain access to quality and safe drinking water for African populations in the future:

Good governance of African institutions in charge of water management.

South-south cooperation between African states which have the same watercourse in common; for the sake of self-sufficiency while developing major joint projects, such as: dams, drinking water treatment plant for consumption.

A good policy of African countries on water management: water security, treatment, and distribution.

Raising awareness among the population, especially those living in deprived areas with limited access to drinking water, on the use and protection of this water resource.

The development and enforcement of laws to regulate industries and those of the agricultural sector so as not to be a source of pollution.

Extend the water management sector to other private international structures in order to share their know-how and expertise in the field with African states in view of the difficulties encountered in the sector; and where states will act as controllers and observers.

And finally, to remove industrial facilities and farms from water sources.

VI. CONCLUSION

It is obvious that the realities of one continent to another are different, as are those of the two bordering countries, but science and technology are always the same anywhere. Africa in these realities and purging in its culture must be able to find the best ways to address and sensitize its population of the good ground of the preservation and the use of water for the well-being of all. The technical contribution of supplying water quality is the responsibility of the government in its water resources management policy. It is true that the financial capacity of African states often does not allow the realization of large-scale hydraulic projects, the option of a win-win partnership with the outside world must be considered.

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Application of Internet of Things in Agriculture.

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Abstract: In India, the most imperative issue ascends in conventional technique is the unevenness in the configuration of climatic conditions (occasional precipitation, soil disintegration and so on) because of which the efficiency is diminished to a noteworthy degree. Another real disservice is these gadgets are yet to reach in the Indian market. The mindfulness is inadequate in the Indian farmers. To decide the dirt ripeness and profiling he needs to movement to adjacent agriculture focuses, which might possibly be available. The data in regards to the dirt conditions are not adequately utilized by the Indian farmers. (Mortenson, M.J.,Doherty, N.F., Robinson, S. 2015). The main objective of the study is to analyse the level of awareness among farmers about Internet of Things process. For this purpose a sample of 75 was collected from the farmers of Coimbatore region based on random sampling method were Percentage Analysis, One Way Anova, Multiple Regression and Kruskal Wallis test were used as samples to analyse the data.

Index terms: Agriculture, Awareness and Farmers, Internet of Things, IoT, Sensor, Precision Agriculture, Smart Agriculture, Networking.

INTRODUCTION

Internet of Things is shaped out of squares working in which sensors, e-gadgets are incorporated. There won't be any human to human communication because of the inclusion of IoT. It is a self - mechanized process. The IoT innovation is more powerful (Peter J.P., & Ryan, M.J., 2017) because of:

- Effective administration of Time.
- Communication and Connectivity.
- Faster get to and decreases human endeavors.

IoT gadgets are relatively utilized as a part of each segment including agriculture. These gadgets give answer for the angles like enhancing the nature of the harvests, soil quality, robotizing water for water system lastly the imperative part – estimating of climate.

Empowering these gadgets in agriculture would help us to balance out our generation and supply, it starts to make more request and draws out an appropriate harmony between the request and supply. A reasonable development is guaranteed by empowering the utilization of IoT gadgets in the agriculture area. In spite of the fact that Indian market is considered as a monster in the agriculture division they are still in the early stages level in productively utilizing the most recent advancements, particularly IoT gadgets (Gubbi J., 2013)

REVIEW OF LITERATURE

Shahzadi R (2016) presented an ES for Cotton crop based on the concept of IoT. They attempted to create and starting casing for IoT-based farming. They built up an IoT-based ES. It's based ES comprises of three modules; the initial segment comprises of the sending of WSN in the cotton fields. WSN has utilized for the checking of the cotton edit condition. The Waspmote agribusiness sensor board has utilized for the checking of the cotton trim condition. It comprises of temperature sensors, stickiness sensors, leaf wetness sensors and soil sensors.

Malavade V, N., (2016) focused on position of IoT in agriculture that leads to smart agriculture. It was found out that IoT minimizes human efforts. Hence, to gain high productivity, IoT works in synergy with agriculture to obtain smart farming.
Sethi P & Sarangi S.R., (2017) proposes a novel taxonomy for IoT technologies, highlights some of the most important technologies, and profiles some applications that have the potential to make a striking difference in human life, especially for the differently abled and the elderly. As compared to similar survey papers in the area, this paper is far more comprehensive in its coverage and exhaustively covers most major technologies spanning from sensors to applications.

Ryan P.J & Watson R.B., (2017) The Internet of Things (IoT) is an extension of the Internet in which large numbers of “things”, including sensors, actuators and processors, in addition to human users, are networked and able to provide high resolution data on their environment and exercise a degree of control over it. It is still at an early stage of development, and many problems/research challenges must be solved before it is widely adopted.

Dijkman R,M.,Sprenkels B., Peeters T & Janssen A., (2015) The Internet of Things is the connection – via the internet – of objects from the physical world that are equipped with sensors, actuators and communication technology. This technology is looked at by a large variety of domains, such as manufacturing, healthcare and energy, to facilitate the development of new applications and the improvement of existing applications. To also enable the commercial exploitation of these applications, new types of business models must be developed. Frameworks exist to facilitate the development of business models.

NEED OF THE STUDY

The Internet of Things (IoT) has the capability to transform the world we live in; more-efficient industries, connected cars, and smarter cities are all components of the IoT equation. However, the application of technology like IoT in agriculture could have the greatest impact. The need of the study is that lack of knowledge among the Indian farmers in adapting the latest technology for better growth.

RESEARCH GAP

The past studies regarding IoT in Agriculture were conducted through secondary data. This paper consists of primary data with questioners regarding the awareness and acceptance of IoT with a sample size of 75 collected from the farmers in Coimbatore district.

THEORETICAL FRAMEWORK

The worldwide populace is set to touch 9.6 billion by 2050. Along these lines, to nourish this much populace, the cultivating business must grasp IoT. Against the difficulties, for example, outrageous climate conditions and rising environmental change, and natural effect coming about because of concentrated cultivating hones, the interest for more nourishment must be met.

Brilliant cultivating in light of IoT advancements will empower cultivators and farmers to diminish waste and improve efficiency extending from the amount of compost used to the quantity of voyages the ranch vehicles have made.

In IoT-based brilliant cultivating, a framework is worked for observing the harvest field with the assistance of sensors (light, stickiness, temperature, soil dampness, and so on.) and mechanizing the water system framework. The farmers can screen the field conditions from anyplace. IoT-based brilliant cultivating is profoundly proficient when contrasted and the traditional approach. (Flannery T, F. 2006)

OBJECTIVE OF THE STUDY

- To analyse the level of awareness among farmers about IoT process
- To analyse about the acceptance towards IoT process among farmers
- Improving quality in terms of production and supply, avoid wastage and better understanding of environmental conditions (soil quality, weather & climatic changes).

RESEARCH METHODOLOGY

The research methodology deals with the research design, data collection methods, sampling method, fieldwork, and the analysis and interpretation of research work.

Research design: The study was conducted in order to find out the farmers awareness towards IOT.

SAMPLING DESIGN & TOOLS APPLIED

Sampling techniques

Sampling Unit:
Sampling unit can be defined as the basic unit containing the farmers with Coimbatore city.
Sampling Size:
In this research, the sample size amount to 75, which are surveyed from farmers with Coimbatore district. And also, the statistical tool are applied viz.
(a) Percentage analysis.
(b) One-Way Anova
(c) Kruskal Wallis
(d) Multiple regression

**Independent variable:** Demographic factors (Age, Gender, Educational qualification, Place of living, and Occupational income).

**Dependent variable:** usage of IOT with various parts of agriculture, awareness towards IOT among farmers, acceptance towards customer perception with IOT.

### DATA COLLECTION

The primary data the respondents which or collected with a questionnaire schedule and secondary data were collected from the manuals, journals, magazines and newspapers etc.

**Research Tool:** Structures self-administered questionnaire had been used as a research tool for collecting.

### PERCENTAGE ANALYSIS

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
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<td></td>
</tr>
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<tr>
<td><strong>Age</strong></td>
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<td></td>
</tr>
<tr>
<td>Below 28</td>
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<td>20.8</td>
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<td>Semi urban</td>
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<td><strong>Total</strong></td>
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</tr>
</tbody>
</table>

### Interpretation
Most of respondents were male (61.3 %) because female respondents were not found on a high ratio in Coimbatore region. Females were not actively involved in the farming sector in and around on Coimbatore district on a high ratio.

The data collected from the respondents belonged to the age group from 20-45. Aged famers (Above 45) were not able to analyze and answer the questions as they were involved with technical aspects to a certain extent in the questionnaire model.

The respondents (farmers) were mostly belonging to rural and semi-rural outskirts of Coimbatore district as the farming practices were identified rarely in the urban areas of Coimbatore as the majority of the city are based on manufacturing hubs.

The income level of most of the respondents were below 5000/- as they were just an employees who gets paid on an hourly-basis and most of them donot go to work on all days in a week. Only a few respondents (4.2 %) have their own land for cultivation.

**One way anova**

**Comparison between age and acceptance towards usage of IoT with various parts of agriculture**

**Descriptives**

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>F</th>
<th>Sig</th>
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<td>16</td>
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<td>3.24</td>
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<td>1.569</td>
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Acceptance towards IOT used in remote control

<table>
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<tr>
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<th>1.620</th>
<th>.324</th>
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Acceptance towards IOT is used in agriculture for harvesting crops

<table>
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<td>1.571</td>
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<td>75</td>
<td>3.12</td>
<td>1.575</td>
<td>.144</td>
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</table>

**Interpretation**

The respondents in the age group of 20-30 feel IoT technologies can be introduced in warehousing and monitoring through CCTV as it do not affect their employment on a greater extent. But the remaining factors are considered as a threat to their employment as the respondents from the age group of 30-45 feel that they earn through the traditional farming in which the technologies are supposed to be introduced. They also fear for the cost factor and feel these technologies involves too much of cost but they are not so.

The major problem is the mindset of the respondents vary according to the age group. The experienced farmers do not accept to go by latest IoT technologies, as the respondents fear these technologies would destroy the traditional farming methods which they are practiced too. Also they donot feel satisfied by using the IoT technologies.

**Kruskal Wallis**

**Comparision between gender and awareness towards factors related to IoT**

**Ranks**

<table>
<thead>
<tr>
<th></th>
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<th>N</th>
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<th>Assumed Sig</th>
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<td>57.96</td>
<td>2666.00</td>
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<td>Total</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Awareness towards E-Mail</td>
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</tr>
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<td>53.62</td>
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<td>Total</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Awareness towards Electronic Communication to users</td>
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<td></td>
<td></td>
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</table>

[http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7612](http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7612)
Interpretation

Majority of the respondents especially female respondents have not crossed their basic education level. Also they were not aware of the latest technologies on electronic gadgets like mobile and computers. The farmers were not that much accessed to the usage of computers and other gadgets as most of them are from rural background. They still use the mobile phones which only contains basic features in it and some of the female respondents even don’t have their own mobile phones. Only a few of the male respondents were accessed to the usage of web and E-Mail that too not frequently.

Regression analysis

Comparison between gender and acceptance towards IoT with various parts of agriculture

<table>
<thead>
<tr>
<th>Model</th>
<th>Coefficients(^{a})</th>
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<tr>
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<td></td>
<td>B</td>
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<tr>
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<td>Acceptance towards farm monitoring based on IOT using CCTV cameras</td>
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<tr>
<td>Acceptance towards IOT helping in real time monitoring of milk levels</td>
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<td>-.004</td>
</tr>
<tr>
<td>Acceptance towards IOT used in remote control</td>
<td>.008</td>
</tr>
<tr>
<td>Acceptance towards IOT is used in agriculture for harvesting crops</td>
<td>.036</td>
</tr>
</tbody>
</table>

Interpretation

Most of the respondents are employees and they consider these technologies as a threatening factor as it would affect their employment opportunities. The female respondents don’t recognize what these technologies of IoT are based on and how it would help them to improvise the production and cultivation of crops. Compared to the female respondents, the male respondents gave a positive response and few of them clearly understand the benefits of these technologies and how it would reduce their efforts. Even though some of the respondents have a clear idea on these factors but they are not ready to accept these IoT based technologies as it would affect their employment.

FINDINGS

- Most of the respondents are not aware of the technologies of IoT in agriculture.
- The respondents prefer to follow traditional way of farming and are not satisfied with the IoT technologies that can be used effectively.
- The water utilized for irrigation purposes are not used effectively.
- The farmers in Coimbatore region prefer to produce cash crops and food crops more than the horticulture crops and plantation crops.

http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7612

www.ijsrp.org
Most of the farmers in Coimbatore deals through middle-man on a commission basis to sell their products in the market.

LIMITATION

• The research was conducted within Coimbatore district.
• The study time was conducted for a period of three months.
• The data collected from the respondents were limited to 75.

CONCLUSION

This study clearly analyzes the awareness level of farmers regarding implementation of IoT in agriculture. This study indicates that we are still in the infant stage of using technologies in agriculture sector. The base stage is that the farmers should be aware of technologies and their benefits to proceed for further process of implementing them. Though Indian market is considered as a giant in the agriculture sector they are still in the infancy level in efficiently using the latest technologies, especially enabling IoT in agriculture. Enabling these devices in agriculture would help us to stabilize our production and supply, initiates to create more demand and brings out a proper balance between the demand and supply. A sustainable growth is ensured by enabling the use of IoT devices in the agriculture sector.

REFERENCE


Viet Nam Cát Bà Island Carboniferous Visean stage reef depositional facies analysis

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DOI: 10.29322/IJSRP.8.4.2018.p7613
http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7613

Abstract: Vietnam Cát Bà island is an area developed Carboniferous Visean stage reef on the world rare in neonatal animal of framework reef, the coral reef of main part by group rugose coral *Donophyllum* sp. and *Thysanophyllum* sp. etc. built, make up the framework corals similar but all by fasciculate and corniform two types developed forms. Reef continuous developed, did not form a distinct gap and period characteristics, reef distribution has certain evolution trend; and within the layers of coral but without the development of evolution characteristics, identify three consecutive biological stage, i.e. plexiform *Donophyllum* sp. developmental stages, the columnar *Donophyllum* sp. development stage and columnar *Thysanophyllum* sp. developmental stages, of reef rock profile micro phase characteristics of that divide out the mud bioclastic packstone and coral lattice frame barrier product rocks, bioclastic grainstone and can identify the three types of sedimentary facies. In the development process of the reef, the reef facies, reef and shoal facies are experienced by the open platform, reef platform, and shallow platform.

Keywords: Cat Ba Island; Guangxi; Carboniferous; reef; comparison

1. Introduction

The Carboniferous period was considered to be a progressive rehabilitation phase in the process of the historical evolution of reef organisms (West, 1988; Webb, 1994; Chevalier et al., 2005; Rodríguez et al., 2012). During the early Carboniferous period, the structure of reef organism lacked breakwater reefs, and were instead characterized by the development of the lime mud mound Waulsortian (Wood, 2001; Riding, 2002; Gong Enpu, 2007).

While populations of microorganisms play an important role during the Visean period, rugose corals were responsible for constructing the grid on which multicellular reef animals were able to reside. Many reef organism developed during the Visean are solid, formed by rugose coral (Rodríguez et al., 2012). This can be seen in areas of the UK, Ireland, Belgium, France, Spain, Ukraine, Algeria, Morocco, Australia, Japan, China, Kazakhstan, Russia and Turkey - I am not sure what is trying to be said with this list of countries, please make sure it was interpreted correctly. However, a full comprehensive is still unclear on the structure and of the Visean reef. After the first discovery of coral reefs during the Carboniferous period the Visean reefs were found in the southern area of Cat Ba Island Vietnam Northeast region (citation needed). Here, we used descriptive analysis of reef platform limestones to identity methods of tectonic and sedimentary characteristics of the North Vietnam. Also, comparing and summarizing reef in the Visean period in Lang Ping Guangxi China, we demonstrate characteristics of reef development during the Visean period Carbon century in South Basin Jiang Hai. As a result, our research provides a more comprehensive awareness about the true development of multicellular animals on reefs in the Visean period.

Cat Ba Island, the largest island in Halong Bay is in Cat Hai district, Hai Phong city the central city, Vietnam (Figure 1). The southern island of Cat Ba is a sedimentary basin in Quang Ninh Northeast Asia of the Bac Bo Basin (Tran Van Tri, et al., 2001). Here, the stratigraphic record Devon-Permian period continued
laying sediments, which Carboniferous stratigraphic developed the Pho Han Formation and the Bac Son Formation (Figure 2). The Pho Han Formation is reef platform sediment or slope sediment, consisting mainly of limestone including thick floors, thin layer of igneous rock, silica and chert limestone. The Pho Han Formation contains samples from the Famennian period to the Carboniferous period (Tran Van Tri, 2008). The Bac Son Formation, formed in a stable environment for long periods, consisting of mostly gray or light gray, thick or lumped limestone floors of sediments. The Bac Son Formation contains a large amount of organisms debris, such as foraminifera, corals, brachiopods etc ...(Tong-Dzuy Thanh, 2005). Nguyen Van Liem pursuant aged the foraminifera from Visean of early Carboniferous to Capitanian stage of Middle Permian period (Nguyen Van Liem, 1985). Han Lo and Bac Son group showed the interactions- of between each other?. The coral reefs used in this study are found adjacent to the Khe Sau road from South of Cat Ba island to Cat Ba town, about 500 meters from the village of Khe Sau (Figure 2). Reefs were from the Visean stage of the early Carboniferous period.

![Fig.1: Geological research area and location of reef](image)

<table>
<thead>
<tr>
<th>System</th>
<th>Series</th>
<th>Stage</th>
<th>Cat Ba</th>
<th>Reef</th>
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<td>Gzhelian</td>
<td>Bac Son Formation</td>
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<tr>
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</table>

http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7613
Cat Ba Island Reef 20°45′14.1 N, 107°01′50.4 E) is an overflow reef running SE-NW and is approximately 6m high, with the exception of the last 12 meters. The main group of reef-building organisms found in reef cores were rigose corals Donophyllum sp. and Thysanophyllum sp. Donophyllum sp. The corals show two growth types, a cluster form and a corner tower form. The dense barrier forming waves created these two forms. In a section of the reef, Thysanophyllum sp. grows in the form of cylindrical mesh angle. Additionally, the sporadic growth of Caninia sp. is on the bottom. The reef organisms were relatively monotonous, with crinoid, hand-rolled algae, foraminifera, gastropods, hard-shelled species and some solitary corals (see Figure 3). Approximately 10 m thick the reef benthos was composed of the corals Donophyllum sp., Syringopora sp., Caninia sp., Caninophyllum sp., this trend continued for 10m away from the reef.

3. Materials and methods

Sedimentary microfacies analysis features tremendous significance for the grasping of Sedimentary environment model in the geological time and the lithofacies-paleo-Geography. Influenced by the F/Fbiota extinction event and the global climate change, the Carboniferous Period was considered a stage of gradual restoration in the process of biological evolutionary process (Chevalier and Aretz, 2005; Rodriguez et al., 2012; Wood, 2001; Webb, 1994). Although many scientists have introduced their own interpretations it is gradually realized that if we can define depositional environment, which is closely linked to the biota extinction sea level change then the mechanism of the biota extinction can be solved.

By using this approach, thirty six samples have been collected from the stratigraphic sections of the coral reef in the Cat Ba Island for microfacies analysis. Under the microscope, the biotypes, degrees of abrasion, rock compositions and the grain parameters in the thin section were examined.

Microfacies have been for long time suggested to be a good indication of sedimentary environment, and are closely associated with sea level change. Therefore, microfacies types are also an important parameters for studying the sea level variation in the past.
4. Microfacies classification and characteristics of the coral reef profiles

4.1 Features reef sedimentary section

Visean reef sections from the carbon period in Vietnam’s Cat Ba Island have pure carbonate sediments that are contained in a thick dark gray floor. The classification study found strong heterogeneity in minster lava of reef limestone (Zhang Yuan Yuan at al. 2009) Visean coral reef of Cat Ba Island is also relatively consistent, based on the general classification method of Dunham and Cuffey (YEAR). The change in organism debris indicates the process of sedimentary forces acting on reef sections. Visean reef sections of Cat Ba Island were divided from the bottom to the top in three categories: packstone stones, bead limestone and coral grid baffles tone stones. (Figure 4).

<table>
<thead>
<tr>
<th>Stratigraphic Series</th>
<th>Stage</th>
<th>Formation</th>
<th>Microfacies</th>
<th>Microfacies types</th>
<th>sea level</th>
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</thead>
<tbody>
<tr>
<td>Early Visean Carboniferous</td>
<td>Bat Sea</td>
<td>CB-1-35</td>
<td>MF1: Organism debris packstone stone (Figure 4A)</td>
<td>Open marine</td>
<td>Low high</td>
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<td>Visean</td>
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<td>CB-1-34</td>
<td>MF2: Coral grid battlestone</td>
<td>Platform-margin reef</td>
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<td></td>
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<td>CB-1-32</td>
<td>MF3: Organism debris limestone particles</td>
<td>Platform-margin sand shoals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CB-1-31</td>
<td>MF3: Organism debris limestone particles</td>
<td>Platform-margin reef</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>CB-1-30</td>
<td>MF3: Organism debris limestone particles</td>
<td>Open marine</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>CB-1-29</td>
<td>MF3: Organism debris limestone particles</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>CB-1-28</td>
<td>MF3: Organism debris limestone particles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CB-1-27</td>
<td>MF3: Organism debris limestone particles</td>
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<tr>
<td></td>
<td></td>
<td>CB-1-26</td>
<td>MF3: Organism debris limestone particles</td>
<td></td>
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</tbody>
</table>

MF1: Organism debris packstone stone (Figure 4A)

This small platform is generally located at the bottom of the reef and the covered floor of coral floors. Organism debris mainly consisted of crinoids and foraminifera, fragments algae and spherical particles-I would list the most common elements, best to not use and so on during a paper. The majority of these organisms are characterized by a plaster shell, calcified mud, or intergranular mud for linked support. This small platform demonstrates the corrosion chips or sheath layers of sediment in small platformicles. Results indicate no access from the reef to the outside and no marine debris interacting with a continental source. Seawater circulation level during this period was adequate, however whole water momentum conditions were relatively weak near the bottom of the waves or below. Therefore, organism debris normally appears in the open shelf environment with open water circulation patterns (FZ7) (Ma Yong Sheng, 2004).

MF2: Coral grid battlestone

This small platform mainly occurred in the reef and the coral floor. Battlestone is formed by a group of rugose coral grow in place with thickly or clusters that hinder organism debris. Coral reef nets usually develop with a typically dense layout, however between individual coral small organism debris can be found (Figure 4). This leads to stiffer frame for breakwater. The coral grid in the coral reef is often scattered and small-scale. This small platform primarily appeared in reef environment (FZ5) (Ma Yong Sheng, 2004).

MF3: Organism debris limestone particles
Organisms debris limestone particles is a small platform that primarily appeared in the covered floor of the reef and the bottom of coral floor (Ma Yong Sheng, 2004). Thorns and foraminifera are common and lead to small quantities of spherical particles and algae debris. Debris from other creatures are rare. The majority of the foraminifera were found in the lime mud. Limestone particles also have small organism debris between interconnected particles. This small platform is similar to the standard platform SMF11, representing the sedimentary environment on the bottom which is affected by waves and usually appear in the shallow shelf boundaries (FZ6) (Ma Yong Sheng, 2004).

Summary analysis of limestone

The Visean reef sedimentary section environment of Visean period in Carboniferous of Cat Ba Island is open shelf environment. Three distinct sedimentary platforms can be identified: the open platform, the reef platform, and the shallow platform.

The order of the Visean reef sedimentary section environment of Visean period in Carboniferous of Cat Ba Island represents a relatively clear process of continuous change between the sea surface and sedimentary environment of corresponding platforms. Beginning the open platform at bottom of the reef, facing up to the coral reef platform, reef covered floor to grow into shallow platform, and then, coral floor once again entered the coral reef platform, finally appears open platform again- I think this would be best described with a figure. The ordering of this platform has shown the development process of Visean reef sections in Carboniferous of Cat Ba Island which has undergone the low-rise evolution time of sea level.

4.2 Typical characteristics of reefs

All biological organisms were identified to the genus level. The diversity of coral reef species of Visean period in Carboniferous of Cat Ba Island was relatively low. Reef organisms consisted mainly of clusters and corner tower forms of Donophyllum sp. and corner tower forms of Thysanophyllum sp. The species diversity of coral reefs in this time frame is relatively high, not only includes clusters and corner tower form of Donophyllum sp. to create coral reefs, but also including a sheet of Syringopora sp. coral and single Caninia sp. and Caninophyllum sp. When considered from the perspective of macro-evolutionary development beyond natural reefs, coral reefs grow continuously, without interruption of characteristic formulation. However, in terms of the distribution of the development of coral reefs an evolutionary trend can be found. The corals grow framing a scattered are with side bounaries that are not clear, therefore the front provided the coral reef, and the latter consisted of the coral floor.

The shape of coral reef and species characteristics indicate the development of coral reefs in Visean period in Carboniferous of Cat Ba Island experienced 3 consecutive stages of development: 1) the development of clusters of Donophyllum sp., 2) the development of corner tower form Donophyllum sp. and, 3) the development stages of corner tower form of Thysanophyllum sp. with Donophyllum sp. developing clusters at the bottom of the reef. These processes are the pioneering elements of reef development, along with the gradual lowering of the sea. As a result of the decreasing sealevel, and increasing water energy, the population of the cluster form of Donophyllum sp. gradually transitioned into populations of the corner tower form. The corner tower form Donophyllum sp. has constituted the core of the reef. Due to the impact of geological scale and the influence outside appearance, we cannot assess clusters and corner tower form Donophyllum to species. However, based on ancient ecology, and the disturbance in water, the subgenus cluster form small-developed colonies, causing the majority of the population to develop into the lump form (J. Robert Dodd, 1989; Yang Shi Pu, 1993). The transition from the cluster form Dodophyllum sp. to the corner tower form Donophyllum sp.
reflects the lower sea level and increased water energy. In the process of reef degradation, the upper part of the reef had the population corner tower form *Donophyllum* sp. replaced by *Thysanophyllum* sp. The cluster part of the *Thysanophyllum* sp. population was relatively small, and could withstand the impact of the increased water energy. Our research area then transitioned into the terrestrial environment, the strength of water disturbance was no longer suitable for the growth of coral, and caused the development of single forms of corals. Along with the gradual increase of the sea surface, and reducing water energy, the water environment was suitable for the growth and development of framing coral, *Donophyllum* sp., *Syringopora* sp., *Caninia* sp. and *Caninophyllum* sp. These framing corals became part of the main floor devoted coral reefs and it is not clear the time period in which they formed.

4.3 Discussion

Coral reefs in Visean period of the Carboniferous system of Cat Ba Island, Vietnam were produced in the shelf of Bac Bo Basin (Tran Van Tri et al., 2001), while coral reefs in Visean period in Lanh Binh Guangxi, China were produced in the shelf of Nam Ban Giang basin (Chen et al. 2013). These reefs are in the "Sea of Nam Ban Giang" (Ruo Wu Hao, 2003), located at the top of Paleo Tethys, Panthalassa connecting the area with the east. We conducted a comparative description of the Visean period reef in Carboniferous of Cat Ba Island, Vietnam and coral reefs in Visean period in Lang Ping Guangxi, China, with the purpose of showing the characteristics of coral reefs in Visean period in the "Sea of Nam Ban Giang

Organism in the reefs of Cat Ba Island-Vietnam, and Lang Ping Guangxi-China, though not the same about the basin, scale reef, reef-building organism populations, reef section platform, are the same age, reef environment and had the similar sea surface conditions. Coral reefs in Visean period in Carboniferous of Cat Ba Island, Vietnam were produced in the shelf of Bac Bo basin (Tran Van Tri et al., 2001), while coral reefs in Visean period in Lang Ping Guangxi, China were produced in the shelf of “Nan jiang” basin (Chen et al. 2013). The difference in overall appearance of the reefs are large, for example the Cat Ba Island-Vietnam exposed approximately 6 m high, and 12 m long. However, Lang Ping Guangxi-China raised approximately 50 m high, and was 260 m long. Although, the same type of reef, the reef of Cat Ba Island-Vietnam had a relatively monotonous reef-type, framed and covered by a limited number of corals and invertebrate species. Lang Ping Guangxi-China was relatively rich in species diversity, including: framed creatures, covered creation, frame, prevent, and adhesion creatures. The framed creatures of two regions were mainly corals. The framing coral of Cat Ba Island-Vietnam is relatively monotonous, only 1-2 types: *Donophyllum, Thysanophyllum* sp. The framing coral Ha Dong Lang Binh Guangxi-China were relatively rich in diversity with *Diphyphyllum, Siphonodendron, Lithostrotion* and *Syringoporasp*. making up the main components of the reef. Cat Ba Island-Vietnam and Lang Ping Guangxi-China had different areas, the organisms that covered them were relatively similar. This is mainly a result of the sedimentary independent growth type of *Syringopora* sp. coral. These corals created the framing creatures breakwater of Cat Ba Island-Vietnam and Lang Ping Guangxi-China. In the framing-breakwater reef, there was only 1 type *Thysanophyllum* sp. in Cat Ba Island-Vietnam, but there were more than one type of coral reefs found in Xiadong Lang Ping Guangxi-China, including Paralithostrotion and Palastraea, coral bones, with grid that prevented particles of organism debris and lime mud. The reef in Cat Ba Island-Vietnam was not a cohesive organism, but in Xiadong Lang Ping Guangxi, China reefs were mainly the microorganisms lava shell with microorganisms. Through identification of natural stone, rock specimen identification and an analysis of creatures small sedimentary minister in the lab, the physical environment of Cat Ba Island-Vietnam area and Lang Ping Guangxi - China are relatively ideal for reef development (such as temperature, water quality, sun levels, food, and oxygen). The environmental conditions of the two regions
were not entirely homologous, these differences caused differences in reef organisms to form. The type of reef in Cat Ba Island-Vietnam is fairly monotonous, simple sedimentary environment, the differences very small, small platform of morphological types are also reduced. The lack of diversity of organisms in the study area is relatively low. Comparatively, the organism diversity of the Lang Ping Guangxi-China region was a rich, complex environment with much larger reef. Although, both Cat Ba Island -Vietnam and Lang Ping Guangxi-China are developed on a carbonate shelf, the different locations demonstrate a difference in scale, and sediment.

<table>
<thead>
<tr>
<th></th>
<th>Cat Ba Island, VietNam</th>
<th>Lang Ping Guangxi, China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reef-building organism</td>
<td>Donophyllum Thysanophyllum</td>
<td>Diphyphyllum Siphonodendron Lithostroton Syringopora Paralithostroton Palastraea Microphorm rock</td>
</tr>
<tr>
<td>Scale reef</td>
<td>Raised about 6m, side lasted about 12m</td>
<td>About 50m high, lateral stretching about 260m</td>
</tr>
<tr>
<td>Development and environment of coral reef</td>
<td>Table</td>
<td>Table</td>
</tr>
<tr>
<td>Microfacies types</td>
<td>The open platform, reef platform and shallow platform</td>
<td>The water of open platform relatively deep/shallow, coral reef platform, slope platform in shelf, shallow platform in shelf</td>
</tr>
<tr>
<td>Sea level</td>
<td>Lower sea surface</td>
<td>Lower sea surface</td>
</tr>
</tbody>
</table>

5. Conclusions
The development of coral reefs in Visean period in Carboniferous of Cat Ba Island, Vietnam is very typical, reefs formed the similarly to the with reefs that developed within the Visean period in Lang Ping, Guangxi, China. Here, we present a detailed analysis and discussion about the creatures of the coral reefs in Visean period in Carboniferous of Cat Ba Island, Vietnam, describing the ecological characteristics, population, growth and development process of the reef. These can be summarized by:

(1) The type of living organisms in coral reefs in Visean period in Carboniferous of Cat Ba Island, Vietnam was relatively low, framing creatures is monotonous. This phenomenon shows that the population during the Visean period in Carboniferous was influenced by biological extinction in late Devonian remained in the recovery process.

(2) Based on the type and combination of reef-creating organisms, coral reef growth Visean period Carboniferous of Cat Ba Island, Vietnam underwent three stages of continuous development.

(3) During the developmental process, Carboniferous of Cat Ba Island, Vietnam has undergone an open shelf platform, a coral reef platform and a shallow platform due to the lowering sea level and increased water energy.

(4) By comparing the Visean coral reef in Carboniferous of Cat Ba Island, Vietnam and Visean coral reef in Lang Ping Guangxi, China it is clear that differences occurred and the time period was complex.
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The Effects of School Based Factors on Academic Performance in Public Primary Schools in Njiru Sub-County, Nairobi Kenya

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Abstract- The study explored effects of school based factors on academic performance in public primary schools in Njiru Sub-County. Academic performance is a product of socio-economic status, psychological and environmental factors. Education in Kenya plays an important role in every part of life for instance political, economic and social development. Secondary school placement and admission depends entirely on the achievement in the Kenya Certificate of Primary Education (K.C.P.E) in standard eight. Today even sponsorship that children from poor parents are supposed to benefit is offered according to the performance in the K.C.P.E results. In Njiru Sub county there has been a relatively below average academic performance. The study used a sample of six schools, six headteachers and one hundred and forty one teachers. The sampling procedure used by the research was the use of 30% of the target population of 18 headteachers and 470 teachers drawn from schools in Njiru Sub-County. The respondents were 6 headteachers and 141 teachers. Random sampling was used to arrive at schools, and teachers. The research instruments used were questionnaires, interviews and observation. The researcher used descriptive survey design and then adopted mixed methods methodology. The research was based on the Effective Schools Model Theory. Data collection was done after obtaining permission from University of Kabianga and a research permit from NACOSTI. It was also concluded that majority of the schools in Njiru do not have enough textbooks which affected their performance. The study recommends that teachers need to be encouraged to undergo professional growth which will help them to maintain and improve their skills on, quality teaching, classroom maintenance and performance of learners.

Index Terms- School based factors, performance, instruction

I. INTRODUCTION

Academic performance is a product of various factors. These include: socio-economic, psychological and environmental factors. Any form of learning where skills, knowledge and habits of a particular group are transferred from a particular generation through means such as: training, teaching and research is referred to as education. Education often takes places when there is guidance; however, there are certain instances where there are no guides but learning takes place, (Agunloye, 2011) This study aims at exploring the effects of school based factors on academic performance in public primary schools. This has been a concern worldwide. Research has shown that successful schools are characterized by certain characteristics or processes which ultimately help learners or the children to learn thus achieving academic goals. Additionally, academic performance is a very important aspect with respect to many academic researchers. Practically it has become a key concern. (Edmond, 1981; Kirk & Jones, 2004) USA addresses academic performance as an integral aspect with regard to education. A poor performing school is seen as a learning institution that is not able to meet the expected standards over repeated assessment cycles. In this light, low performing schools are seen as poor schools. As such, these schools are often associated with a wide range of problems that would seem to defy applicable solutions. There are many problems that are associated with poor academic performance in public schools (Agunloye, 2011) these include: low academic expectation, high dropout rate, high indiscipline problems, low student, and teacher morale and poorly managed facilities.

Additionally, they focus on the observable symptoms rather than the symptoms on the root cause. Shama Ahanta Metropolitan Assembly is one of the districts Assemblies in the western region of Ghana where schools have shown poor performance in all public examinations and one director had to put it at “their BECE results have been appalling.” The schools in the sub-metro have been performing poorly in national performance monitoring tests administered by the Ghana Education Services. And they have also performed consistently poorly in the mock basic education certificate examination BECE. (Agunloye, 2011)

There is a growing number of literature works that have focused on the factors affecting academic performance in Africa. A vast majority of researchers have argued that their class attendance, attitude, study environments, resources, study behaviors, time and study skills heavily determine academic performance in public primary schools. To start with, class attendance has been placed as the predictor of academic performance (Obugu, 2004).
Pupils who attend classes regularly will often be associated with good performance as opposed to the ones that don’t. Attitude has also been placed as another determinant for academic performance (Wekesa, 1993). A positive attitude will always be associated with good performance as opposed to a negative one. When a pupil is confident in himself or herself academically; there will be good results as opposed to when there is no self confidence amongst the pupil. Attitude has however been associated with some pupils. As such, this has not been applicable to all. (East Africa).

In Kenya, the major yardstick for measuring educational output is performance in the K.C.P.E and K.C.S.E, with educators and policy makers focusing on testing accountability, curriculum and teacher quality. The importance placed on examinations has made stakeholders come up with strategies aimed at improving students’ performance in examinations school choice and related concerns (Juma 2011). Majority of authors have raised their own rationale based on their research. In fact, each author has shown certain factors that are attributed to this case. This is on a general context and relies on factors that have been evident in a majority of public schools found in Kenya. As such, this is not in line with the subject matter. On a district level, there are a growing number of authors that have chosen to critically address this matter with respect to their chosen location. While there has not been much in this particular area (physical area), there are certain works that have reflected some vital aspects with regards to the subject matter. This study has raised factors such as; Head teachers and teachers’ relationships and provision of resources, time management as factors that influence academic performance in Njiru Sub County. Therefore, in Njiru the dismal performance could be due to the same factors. The study is going to explore the effect of these factors on the academic performance.

Statement of the Problem

Academic performance is evaluated based on examinations given and the attainments by learners in such examinations. Provision of good quality education that can foster good academic performance require adequate resources inform of textbooks (Mbatia, 2004). The academic performance in national examinations KCPE by public primary schools in Njiru Sub-County has been dismal. The KCPE is marked out of 500 marks and the poor performance is a mark below 250 marks. From the year 2010 to 2013, only two public primary schools got a mean score of above 250. The sixteen remaining schools got a mean score of below 250 (Wario, 2015).

Despite the government measures like allocating money for resources for the free education to boost academic performance in public primary schools, Njiru Sub-County has been persistently performing below average. With the below average performance, there is need to investigate why academic performance has remained dismal. Therefore, this study proposes to explore the effects of school based factors such as time management, lack of teachers, textbooks, lack of supervision by headteachers on teachers and headteachers leadership styles on academic performance.

Justification of the Study

Student academic performance is important in all institutions of learning. The rationale for carrying out this study other researchers have looked at other causes of poor performance for example causes like teachers’ qualifications, students’ background, poverty and even parents’ academic background.

Other researchers have also looked into the use of language in giving instructions and poor leadership styles as causes of poor performance but the area of school based factors has not been looked into exhaustively especially the proper use of resources and time (Schneider, 2003).

Academic performance is key and since the schools do receive free primary education money and still perform poorly, therefore the researcher would like to explore the use of resources, time management, head teachers leadership styles and head teachers super vision on teachers.

II. REVIEW OF LITERATURE

Teacher qualifications

According to Darling – Hammond (1998), a well-qualified teacher is one who was fully certified and held the equivalent of a major in the field being taught. Although the formal qualification of teachers is an important indicator for their knowledge and competence in teaching, it has only limited utility in analyzing how well prepared teachers are for what they have to teach in schools. More detailed knowledge of the courses they have taken during their training needs to be compared to the actual content and skills required to teach the high school’s curriculum.

Ruthland & Bremer (2002) explains teacher qualification in two ways - traditional and alternative qualification routes. Traditional certification is when an individual completes an undergraduate degree or post graduate program in education. Alternative routes of certification are based on coursework in pedagogy and subject area without a degree in education. On the other hand, Hardy & Smith (2006) cite short term activities such as mentoring, peer evaluations and workshops as ways other than formal qualifications for improving teaching. More often graduates teachers with first degree content go into teaching if they cannot find another job right away. Although they often get somewhat lower salary than a fully qualified teacher; they choose not to enroll in the one year post - graduate professional training and therefore lack a basic foundation for teaching.

Maundu (1986) concludes that there was significant correlation between teacher qualification and pupil performance in Kenya. The good performance was attributed to excellent instructions given by qualified teachers in addition to other inputs. He establishes that teachers who had graduated from Kenya Science Teachers College were more practically oriented than those who had degrees from public universities while Wilson et al. (2001) suggest that even with the shortcomings of current teacher education and licensing, fully prepared and certified teaches are more successful with students than teachers without this preparation.

Asikhia (2010) conducted a study on students’ and educators’ perceptions of the causes of poor performance in secondary schools. Subjects for the study were 50 educators randomly selected from 5 schools in Ogun state. Questionnaires...
were used to collect data for the study. Percentages and chi square were used to analyze the study. Asikhia’s study (2010) revealed that educators’ qualifications influence students’ academic performance. Many studies (Stronge, et al., 2007; Asikhia, 2010; Dobbie, 2011 & Fakeye, 2012) found that learners achieve more when exposed to better learning conditions and much more qualified educators.

The present researcher also believes that if educators can acquire proper training and certification, matched with the identification and assessment of proper teacher dispositions this will have a significant impact on pupils performance. Limited research is available in Kenya and specifically Njiru sub-county on the relationship between teachers’ qualifications and performance of pupils. This study will therefore fill this gap.

**Provision of Resources (Teachers and Textbooks)**

Many counties in Kenya are still facing many problems in provision of high quality education. Njiru Sub County is not an exemption. These Challenges are still evident. Factors relating to the economy, manpower are attributed to this case. On a global scale, since World War 11, education has been termed as an integral tool with respect to alleviating poverty and bringing tangible social and economic change. According to article 13 of human rights (1948), education has been termed as a basic right. As such, everyone is entitled to have education for full development of the human personality. Additionally, education has been set as a means for accessing other human rights. This entails that; the former will unlock the latter.

Availability of teaching materials therefore enhances the effectiveness of schools as they are the basic resources that bring about good academic performance in the students. The necessary resources that should be available for teaching and learning include material resources, human resource such as teachers and support staff and, physical facilities such as laboratories, libraries and classrooms.

Material resources include textbooks, charts, maps, audiovisual and electronic instructional materials such as radio, tape recorder, television and video tape recorder. Other category of material resources consist of paper supplies and writing materials such as pens, eraser, exercise books, crayon, chalk, drawing books, notebooks, pencil, ruler, slate, workbooks and so on (Atkinson, 2000).

Good teaching is best done in classes with small number of learners that allow for individual attention. This is critical since in large classes where they are up to eighty seven pupils in a class, a teacher may not be in a position to reach out to each pupil. Therefore the issue of resources has not been looked into in Njiru Sub-County.

**Head teachers’ Leadership Styles**

This is a very important aspect with regard to the performance of students in Njiru. On a global scale; learning institutions that have good relationships between the head teachers and teachers have emerged out to be successful as opposed to the ones that have poor relationships. Education management in primary schools entails proper application of management principles in developing resources that are geared towards achieving academic goals (Mbiti 1974).

While vast majorities of heads in Njiru often try to practice this aspect, there is still a need for strategic mechanism for monitoring teachers. In fact, heads in Njiru are obligated to ensure that teachers are in line with the expectations of the pupils, parents and the community.

Head teachers must also ensure that there is motivation, especially towards the teachers. This entails that there must be motivation that enables teachers to value their jobs and even the students. Practically, when teachers in a school have low expectations for students, it is a reflection of low expectations for themselves and their job (Stephen, Lindah, Michelle, and Debra, 2005). This may be as a result of negative perceptions of the students and their circumstances of poor leadership directives, poor facilities and poor classroom management, poor relationship with students and peers, low morale, frustration, fatigue burnout and high turnover (Seels & Richey 1994).

## III. RESEARCH METHODOLOGY

The study used descriptive survey design and adopted a mixed method methodology. This was used to explore the effects of school based factors on academic performance.

By involving a broad category of stakeholders, the study fits within the cross sectional sub-types of descriptive study design. The sub-type to be used is ex-post facto. This is a design which study variables which are not exposed to direct manipulations or intervention on the part of the research. In this research, the only control provided for is on limiting the responses to specific category, teachers and head teachers of the selected schools.

**Target Population**

There are a total of eighteen public primary schools in Njiru Sub County. There are a total of four hundred and seventy teachers (470). The study was conducted in six (6) of the public primary schools. The head teachers in Njiru are eighteen (18) head teachers of whom the researcher choose the six of them.

**Sample Size and Sampling Procedures**

The researcher dealt with the 30% of the school’s population in Njiru Sub-County. The research selected six (6) schools which is 30% of the targeted population of schools in Njiru Sub-County. Further, the teachers were chosen from the six schools. Simple random sampling technique was used to arrive at the respondents from the selected schools. These were six (6) head and one hundred and forty one (141) teachers.

**Data Collection Instruments**

Data was collected using the triangulation method that included questionnaire, interviews and observations.

**Data Analysis and Presentation**

The study used Statistical Package for Social Sciences (SPSS) to analyze data. This was done by first cleaning, Coding, entering and then analyzing. The data was analyzed both qualitatively and quantitatively. Quantitative data was edited to eliminate inconsistencies, summarized and coded for easy classification in order to facilitate tabulation and interpretation. Descriptive statistics were used in describing the sample data in a
way to portray the typical respondents and to reveal the general response pattern.

Analyzed data was presented inform of percentages, means, standard deviations and frequencies. Open ended questions which elicited qualitative data were analyzed according to themes based on research questions and objectives and conclusions were drawn.

Ethical Considerations

Ethical issues were considered. The researcher sought permission from the primary schools selected for data collection. A letter of introduction from the University of Kabianga was sought to ascertain that the researcher was a student at the institution.

IV. RESULTS

Effect of availability of qualified teachers on academic performance

The findings noted that the teachers were qualified as depicted by the 3 (50%) of the headteachers who agreed and the same number who strongly agreed. As noted by Huang & Moon (2009) teacher qualification accounted for approximately 40 to 60 percent of the variance in average of students’ achievement in assessment. This implies that availability of qualified teachers contribute to better achievements in examinations.

Teachers response on the availability of qualified teachers

Teachers responded on availability of qualified teachers established that majority 123 (89.1%) agreed that the teachers were qualified while 3 (2.2%) disagreed. It was however noted that 12 (8.7%) were undecided on their responses. A survey carried by the Kenya National Examinations Council (KNEC) established that teacher professional training and experience had an impact on pupils performance, with pupils who were taught literacy by teachers with higher professional qualifications and those teachers with many years of experience performing better than pupils taught by teachers with lower professional qualifications and fewer years of experience (Kandie, 2015).

Headteachers response on Teacher Pupil Ratio of 1:40

The head teachers’ responses on teacher pupil ratio of 1:40, the results showed that majority of the head teachers disagreed that the ratio is 1:40. This was shown by 2 (33.3%) who strongly disagreed and 3 (50%) who disagreed. Only 1 (16.7%) agreed. The findings are in line with the findings of Kaloki (2012) which established that there was a higher student teacher ratio which contributed to poor performance of pupils in primary schools in Machakos County. This implies that the classes have a high teacher pupil ratio. The recommended Teacher pupil ratio for public primary schools in Kenya is 1:40 (TSC, 2006) which is also ideal ratio set by UNESCO and other international standards.

Extent to which textbooks influence academic performance

Table 1: Pupil to book ratio 1:1

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
</table>

| agree     | 5         | 83.3    |
| strongly agree | 1         | 16.7    |
|Total      | 6         | 100.0   |

The results of the headteachers responses on pupil to book ratio being 1:1 noted that all the headteachers agreed that the book ratio was 1:1. This was indicated by 5 (83.3%) of those who agreed compared to 1 (16.7%) who strongly agreed. The results imply that the number of books are less in relation to the number of pupils. This may be attributed to loss of by the pupils. The government provide books for all pupils but most of them are damaged or lost and are rarely replaced.

Table 4.2: Teachers do not use teaching aids because they are not prepared

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>strongly disagree</td>
<td>6</td>
<td>4.3</td>
</tr>
<tr>
<td>disagree</td>
<td>46</td>
<td>33.3</td>
</tr>
<tr>
<td>undecided</td>
<td>9</td>
<td>6.5</td>
</tr>
<tr>
<td>agree</td>
<td>52</td>
<td>37.7</td>
</tr>
<tr>
<td>strongly agree</td>
<td>25</td>
<td>18.1</td>
</tr>
<tr>
<td>Total</td>
<td>138</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The results of table 4.2 above noted that 52 (37.6%) do not agree that they do not use teaching aids because they are not prepared, 9 (6.5%) were undecided, while 77 (55.8%) agreed. This implies that majority of the teachers agree they do not use teaching aids because they are not prepared. The study concurs with the findings of Kimosop (2015) which concluded that teachers were not always prepared in the use of instructional resources.

V. CONCLUSIONS & RECOMMENDATIONS

Summary

Effect of availability of qualified teachers on academic performance

The findings noted that the (3) 50% of the schools indicated teachers in Njiru sub-county were qualified. The findings further reported that (3) 50% of the headteachers do not agree with the teacher pupil ratio of 1:50. The observation checklist on teacher pupil ratio revealed that majority (5) 83.3% of the schools had a teacher pupil ratio of 1:60-1:70 while only (1) 16.7% had a ratio of 1:40-1:50.

Extent to which textbooks influence academic performance

The findings of the headteachers responses on pupil to book ratio being 1:1 noted that all the headteachers agree that the book ratio was 1:1. This was however contradicted by the teachers who majority (95) 68.8% disagreed with the statement that the book ratio was 1:1. Majority (4) 66.6% of the teachers disagreed that the supplementary book ratio was 1:1 while (1) 16.7% was undecided.

The results of the observation established that maths and language books were shared in all the schools. Four 66.7% of the schools had a ratio of 1:3 while 2 had six pupils sharing a book. Other textbooks were also shared by 6 pupils in majority 83.3% while one of the schools (1) 16.7% had one book shared by 10

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pupils. On supplementary books, all the schools had very few books which forced 10 pupils sharing 1 book. The findings do not agree with the results of the headteachers questionnaires, this could be attributed to loss of the books and no replacement being made.

**Effects of headteachers leadership styles on academic performance**

The results of headteachers practices instructional resources revealed that all the teachers agreed that the headteachers practices on instructional resources affect academic performance in schools. The findings on lack of follow up by headteachers revealed that majority 55.8% agreed.

**VI. CONCLUSIONS**

Based on the findings of the study, the following conclusions were made;

1. The study concluded that qualifications of teachers improved performance of learners. When the teachers are qualified, they are well conversant with preparation of scheme of work, lesson plans and students progressive reports.

The study further concluded that majority of the schools in Njiru do not have enough textbooks which affected their performance. Pupils shared a textbook which in some cases a book was shared by up to 7 pupils. This affected the pupils’ completion of work and revision. It is the proper utilization of textbooks that makes an effective school. Textbooks make up the curriculum package and when the learners use them consistently and meaningfully, with appropriate guidance from the teacher they may achieve the intended learning outcomes as well as the improved performance. Quality interaction with the textbooks helps the student integrate the knowledge or content in his or her mental structure: they become part of the furniture of the minds of the student so exposed to the content and skills.

**REFERENCES**


Micro Climate Behavior on Cauliflower Plant Canopy in Intercropping System with Sweet Corn in Central Kalimantan

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Abstract - This study aims to observe and examine the micro climate behaviour on intercropping pattern of cauliflower with sweet corn in Central Kalimantan, which performed in May to September 2016, in Kalampangan, Palangka Raya, Province of Central Kalimantan. This research applied split plot design, consisted of main plot, i.e. planting period of sweet corn consisted of 3 levels, W1 = 4 weeks prior to planting of cauliflower, W2 = 2 weeks prior to planting of cauliflower and W3 = at the same time planting with cauliflower ; as subplot was planting spacing in row of sweet corn consisted of 3 levels : J1 = 60 cm, J2 = 30 cm and J3 = 20 cm. Data analysis used diversity analysis, if there was significant effect between treatments, further continued to Least Significance Different (LSD) test 5% and regression analysis. The result showed that setting of planting sweet corn 2 weeks before planting cauliflower and planting spacing in a 60 cm sweet corn sequence can modify the microclimate above the canopy of cauliflower plants, which is able to reduce the intensity of radiation and air temperature and increase air humidity above the cauliflower canopy making it suitable for the growth and yield of cauliflower at high temperature in Central Kalimantan.

Index Terms - Air temperature, air humidity, radiation intensity, intercropping, cauliflower.

I. INTRODUCTION

Central Kalimantan lies in the position of 0° 45' north latitude -3° 30' south latitude and 110° 45 - 115° 51 east longitude. Central Kalimantan is one of the provinces passed by the equator. Altitude of Central Kalimantan on swamp areas was around 0 to 50 metres above the sea level and hills was around 50-100 metres above the sea level, and is dominated by peatlands. Data for 2016, the Central Kalimantan region gets an average solar radiation of 55.79%. The temperature is quite hot, which can reach maximally 35.06°C at noon while the average temperature is 27.4°C with rainfall 289.36 mm3 and rainy day 201.60 days [1].

During the growth stage, plants are affected by environmental factors with unavoidable risks. which includes sudden temperature increases, changes in CO2 content, and rainwater supply, rising atmospheric temperatures will cause the loss of soil moisture and will increase the need for plants for water [2]. The cultivation of cauliflower crops has already been applied in tropical lowland, but inhibited by many obstacles. The main obstacle of cauliflower cultivation in tropical lowland is insupportable environmental factors, such as insuitable agroclimate to its growth. High temperature and radiation intensity are inhibition factors of vegetable production with moderate climate in tropical area [3]. Cauliflower also requires more specific environmental conditions than other cabbage types [4]. Microclimate elements such as air temperature, solar radiation, and moisture support and play an important role in influencing soil conditions as well as crop production [5]. In order for cauliflower plants are cultivated in the tropical lowland producing high quality and size flower, therefore micro climate modification is needed, especially during transition phase from vegetative phase to generative phase [6].

Planting of cauliflower with intercropping pattern is a way to modify micro climate in simple and cheap way. Air temperature of canopy in intercropping pattern was lower than the monoculture. Higher transpiration increases relative humidity and the energy penetrating the canopy was used to photosynthesize and production process [7]. Therefore, by intercropping system of cauliflower and sweet corn, perhaps it will set appropriate micro climate condition for cauliflower crops planted in tropical lowland at high air temperature. This research aims to observe and examine the micro climate behaviour on the canopy of cauliflower crops in intercropping pattern with sweet corn in Central Kalimantan.
II. RESEARCH METHODOLOGY

1. Location, time, materials and research equipment
This study was performed in peatland of Kalampangan Village, Palangka Raya City of Central Kalimantan Province, Indonesian Country. This location was 35 metres above the sea level with average temperature of 27°C – 32°C. Materials used in this study were sweet corn seeds of Bonanza variety, cauliflower seeds of PM 126 variety, chicken manure and anorganic fertilizer (Urea, SP-36, and KCl), and burnt ash. Tools used in this study were thermohygrometer, solar meter, analytic scales, digital camera, meter scale, ruler, scissor, hand sprayer, knives, buckets, LAM, oven paper envelopes.

2. Experimental design
This study applied split plot design, consisted of main plot, i.e. planting period of sweet corn and subplot i.e. planting spacing of sweet corn and repeated 3 times. Main plot was planting period of sweet corn, consisted of 3 levels, \( W_1 = 4 \) weeks prior to planting of cauliflower, \( W_2 = 2 \) weeks prior to planting of cauliflower and \( W_3 = \) at the same time planting with cauliflower. Sub plot was planting spacing in row of sweet corn consisted of 3 levels : \( J_1 = 60 \) cm, \( J_2 = 30 \) cm and \( J_3 = 20 \) cm. Monoculture of cauliflower was used as comparison indicator of rate micro climate change around the cauliflower in intercropping pattern.

3. Conducting field research
Cauliflowers were planted with spacing of 60 cm x 60 cm in trial plot of 3.0 x 5.4 metres, meanwhile sweet corns were planted with spacing between row of 120 cm and spacing in a row based on each treatments. Cauliflower crops were fertilized with anorganic fertilizer (Urea 200 kg.ha\(^{-1}\), SP-36 250 kg.ha\(^{-1}\) and KCl 150 kg.ha\(^{-1}\)) and manure 10 t.ha\(^{-1}\), also burnt ash 10 t.ha\(^{-1}\). Fertilizer SP-36 and KCl were applied in 7 days after planting, while the urea fertilizer was applied twice in 7 and 21 days after planting, half of dose for each treatments. Application of urea fertilizer and burnt ash was performed 2 weeks prior to planting. Sweet corn crops were fertilized by urea 200 kg.ha\(^{-1}\), 100 kg.ha\(^{-1}\) SP-36 and 100 kg.ha\(^{-1}\) KCl. While for SP-36 and KCl fertilizer were applied at once in 7 days after observation, whereas urea fertilizer was applied in 7, 28, and 49 days after planting, 1/3 of dose for each treatments.

4. Microclimate observation
Observation of micro climate was performed in 14, 21, 28, 35, 42, and 49 days after observation (DAO). Observations of temperature and humidity are carried out on the canopy of cauliflower plants at 07.00 - 07.30; 12.00 - 12.30 and 16.00 - 16.30, while for solar radiation observation only done at 12.00 - 12.30 [8].

III. RESULT AND DISCUSSION

1. Influence of Planting Period and Spacing on Intercropping System to Changes in Micro Climate Behavior
Cultivation of cauliflower in Central Kalimantan requires crop management techniques in accordance with environmental conditions. This is because the Central Kalimantan has a high temperature and light intensity making it less suitable for cultivation of cauliflower. The success or failure of cauliflower production is heavily dependent on climate, controlling temperature and this relationship is very intensive and complex [9].

The result showed no visible change of micro climate behaviour occurred in 14 DAO, the new changes occurred next to 21 DAO (Table 1). It was because in the beginning of growth, sweet corn crops were short and had less leaves, so their effect on cauliflower crops was not significant yet. There was no interaction between planting period and crop spacing in row of sweet corns to all observations of micro climate behaviour. Treatment at planting periods and planting spacing in row of sweet corn crops separately affected micro climate behaviour above the canopy of cauliflower crops. It showed both treatments were independent to affect micro climate components, but each treatments independently affected the micro climate components significantly, whether the temperature, humidity, or radiation intensity.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Temperature (%)</th>
<th>Days after Observation (DAO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
<td>21</td>
</tr>
<tr>
<td>( W_1 ) (4 weeks prior to CF)</td>
<td>26,9</td>
<td>26,2 a</td>
</tr>
<tr>
<td>( W_2 ) (2 weeks prior to CF)</td>
<td>27,8</td>
<td>27,1 ab</td>
</tr>
<tr>
<td>( W_3 ) (along with CF)</td>
<td>28,1</td>
<td>27,6 b</td>
</tr>
</tbody>
</table>
Table 1 shows that the arrangement when planting sweet corn affects the temperature on the canopy of the cauliflower plant 21 DAO, whereas the slower the cultivation of sweet corn increases the temperature above the cauliflower canopy. Explains that the temperature drop is correlated with reduced solar radiation received by the plant canopy [6]. At 35 - 49 DAO showed, sweet corn planting 4 weeks before cauliflower planting (W₁) causes the lowest temperature above the canopy between other treatments. While for sweet corn planting together with cauliflower (W₃) causes the air temperature above the canopy cauliflower plants to be higher though not different from the planting period 2 weeks before planting cauliflower (W₂).

In 35 to 49 DAO, planting of sweet corn with spacing between crops in row of 60 cm (J₁) resulted highest temperature above the of cauliflower crops, otherwise spacing between crops in row of 20 cm showed lowest temperature among the other planting spacing treatments. As wide the spacing between crops in row of sweet corn yielded higher temperature above the canopy of cauliflower crops. This was caused by the sunlight penetrating onto the canopy of cauliflower was not blocked by leaves of sweet corn crops.

Table 2. Air humidity above the canopy of cauliflower crops (%) caused by setting of planting period and planting spacing of sweet corn in intercropping system between cauliflower and sweet corn

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Humidity (%) Days after observation (DAO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Planting period of SC (W)</td>
<td></td>
</tr>
<tr>
<td>W₁ (4 weeks prior to CF)</td>
<td>78.0</td>
</tr>
<tr>
<td>W₂ (2 weeks prior to CF)</td>
<td>79.5</td>
</tr>
<tr>
<td>W₃ (along with CF)</td>
<td>78.2</td>
</tr>
<tr>
<td>LSD 5%</td>
<td>ns</td>
</tr>
<tr>
<td>Planting spacing of SC (J)</td>
<td></td>
</tr>
<tr>
<td>J₁ (60 cm)</td>
<td>78.3</td>
</tr>
<tr>
<td>J₂ (30 cm)</td>
<td>79.2</td>
</tr>
<tr>
<td>J₃ (20 cm)</td>
<td>80.1</td>
</tr>
<tr>
<td>LSD 5%</td>
<td>ns</td>
</tr>
<tr>
<td>Monoculture of CF</td>
<td>77.96</td>
</tr>
</tbody>
</table>

Annotation: Amounts in same columns and accompanied with similar alphabets showed non significant on LSD test 5%.
ns = non significant, SC = sweet corn, CF = cauliflower
whose long and plenty enaugh to enchanced highly air humidity above the canopy of cauliflower. Shelter played a role to reduce lighting intensity and high temperature, also increase the air humidity [10].

Table 3. Radiation intensity (cal.cm$^{-2}$.second$^{-1}$) above the canopy of cauliflower caused by setting of planting period and planting spacing of sweet corn in intercropping system between cauliflower and sweet corn

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Radiation intensity (cal.cm$^{-2}$.second$^{-1}$)</th>
<th>Days after observation (DAO)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Planting period of SC (W)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$W_1$ (4 weeks prior to CF)</td>
<td>1.082</td>
<td>992 a</td>
</tr>
<tr>
<td>$W_2$ (2 weeks prior to CF)</td>
<td>1.115</td>
<td>1.050 b</td>
</tr>
<tr>
<td>$W_3$ (along with CF)</td>
<td>1.126</td>
<td>1.098 c</td>
</tr>
<tr>
<td>LSD 5%</td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Planting spacing of SC (J)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$J_1$ (60 cm)</td>
<td>1.129</td>
<td>1.140 c</td>
</tr>
<tr>
<td>$J_2$ (30 cm)</td>
<td>1.105</td>
<td>1.035 b</td>
</tr>
<tr>
<td>$J_3$ (20 cm)</td>
<td>1.088</td>
<td>965 a</td>
</tr>
<tr>
<td>LSD 5%</td>
<td></td>
<td>39</td>
</tr>
<tr>
<td>Monoculture of CF</td>
<td>1,185</td>
<td>1,183</td>
</tr>
</tbody>
</table>

Annotation : Amounts in same columns and accompanied with similar alphabets showed non significant on LSD test 5%. ns = non significant, SC = sweet corn, CF = cauliflower

Among the various factors of resource competition, the light factor is one of the factors that determine success in the intercropping system [11]. Setting of planting period of sweet corn in intercropping pattern with cauliflower affected the changes of radiation intensity above the canopy of cauliflower crops. Spacing between crops in row of sweet corn affected the radiation intensity penetrating the canopy of cauliflower crops. Table 3 showed that in 21 to 28 DAO, planting of sweet corn 4 weeks prior to planting of cauliflower ($W_1$) caused lowest rate of light intensity above the canopy of cauliflower crops than other planting periods. Planting of sweet corn with range between crops of 50 cm caused greater radiation intensity penetrating the canopy of cauliflower than planting spacing of 20 and 30 cm. Wide planting spacing caused sunlight freely penetrating the canopy of cauliflower, so otherwise. Higher rate of shelter was obtained in spacing between row of sweet corn 20 and 30 cm. This was compatible with observation of 21 and 28 DAO, setting of planting spacing between sweet corn of 20 cm ($J_3$) caused lowest radiation intensity above the canopy of cauliflower crops. Light factor might had positive or negative impact to crops growth. Less shelter might reduce the radiation intensity, therefore might accelerate flowering on cauliflower positively [12]. Plant density of 75 cm × 20 cm had the highest light interception compared to the density 60 cm × 20 cm and 75 cm × 40 cm. Dry matter production increased with light interception and was highest at 105 DAP when light interception was between 55% and 60% for all Arachis varieties [13].

The earlier cultivation of sweet corn from cultivation of cauliflower, the less radiation intensity that reaches above the cauliflower canopy. In 35 to 49 DAO, planting of cauliflower 4 weeks after planting of sweet corn caused lower radiation intensity above the canopy of cauliflower, although insignificantly different with planting of sweet corn 2 weeks prior to planting of cauliflower.

2. Relationship Between Three Micro Climate Factors to Plant Growth of Cauliflower in Intercropping and Monoculture System

To produce a microclimate in accordance with the growth stage of cauliflower, it is necessary to adjust the planting time and distance in the line of sweet corn plants on the intercropping system. The intercropping system can improve the interception of light, reduce evaporation and improve soil moisture. Intercropping cultivation between high and low habits can reduce the intensity of light and air temperature, and increase relative humidity [7]. In Figures 1, 2, 3 and 4 it is known that the intensity of radiation and air temperature above the cauliflower canopy at monoculture planting is higher than the intercropping system. High temperatures and high light intensity especially in the flowering initiation phase will inhibit the formation of flowers as it enters the transition phase from vegetative to flowering, flower cauliflower plants require low temperatures to induce flowers [15]. The intercropping system produces lower light intensity and temperature than cauliflower monoculture.
When planting sweet corn has a real effect on micro-climate change in canopy cauliflower plant. Figures 1 and 2 explain that each treatment when cultivating sweet corn in the intercropping system has different effects on changes in temperature and light intensity. At the planting of sweet corn 4 weeks before planting cauliflower (W1), indicated that along with increasing of plant age hence intensity of sunlight entering into canopy cauliflower become decreased \( Y = 1159.75 - 8.32x, R^2 = 0.74 \) so the temperature above canopy cauliflower plants also lower \( Y = 28.04 - 0.081x, R^2 = 0.76 \). In the treatment of sweet corn planting together with cauliflower (W3) indicated that, with increasing age of the plant, the intensity of sunlight reaching the canopy of the cauliflower plant is still quite high \( Y = 1272.17 - 8.39x, R^2 = 0.79 \) which causes the temperature above the canopy of the cauliflower plant to be high \( Y = 29.31 - 0.079x, R^2 = 0.71 \) to enter the flower initiation phase. It shows that the micro climate change around the cauliflower plant is influenced by the time of planting sweet corn as a shade plant. The canopy architecture of sweet corn played critical role in how much solar radiation might be intercepted via planting other crops in intercropping pattern. The high level of shade and the low intensity of radiation cause the air humidity above the cauliflower canopy to be higher [16].

Sweet corn planting 2 weeks before planting cauliflower produces suitable micro climatic changes for lowland cauliflower cultivation with intensity and high temperature. Figure 1 shows that sweet corn planting 2 weeks before cauliflower (W2) decreases radiation intensity \( Y = 1242.13 - 8.90x, R^2 = 0.74 \), and as the age of the plant increases, the light intensity reaches the canopy of the plant cauliflower so as to produce an appropriate temperature to stimulate flower initiation in the cauliflower plant. Figure 2 shows a decrease in temperature above the canopy of the cauliflower plant as the age of the plant increases on the intercropping system \( Y = 28.99 - 0.09x, R^2 = 0.81 \). In cauliflower monoculture showed a slight increase in the observation of radiation intensity and air temperature in accordance with increasing plant life.
In Figures 3 and 4 it is seen that the more tightly spaced on the sweet corn sequence can decrease the intensity of light and air temperature above the canopy of the cauliflower plants in the intercropping system. Based on the results of linear regression analysis it is known that with increasing age of plants, will decrease the intensity of light and temperature more quickly, this occurs in J3 when sweet corn is planted with spacing 20 cm \( (Y = 1158.15 - 8.19x, R^2 = 0.76 \) and \( Y = 28.53 - 0.09x, R^2 = 0.81 \)). While the decrease in light intensity and the slower temperature occurs when sweet corn is planted with a spacing of 60 cm \( (J_1) \) on the intercropping system. In cauliflower monoculture showed a slight increase in the observation of radiation intensity and air temperature in accordance with increasing plant life \( (Y = 1155.21 + 1.45x, R^2 = 0.75 \) and \( Y = 28.10 + 0.017x, R^2 = 0.34 \)). To produce good quality flowers, it is important to note when the transition from the growth phase to the flowering phase, ie cauliflower plants require low air temperature. This occurs because the induction of flowering is caused by light, temperature, water availability, nutrients or chemicals such as hormones and growth regulators [10]. It is therefore very important to regulate the temperature and intensity of radiation.

Sweet corn planting with a distance in the 60 cm line \( (J_1) \) produces a microclimate condition that is more suited to the growth of the cauliflower plant. This can be seen in Figure 3 \( (Y = 1292.62 - 8.88x, R^2 = 0.77) \), so that in the vegetative phase, cauliflower plants get enough sunlight to process photosynthesis. While at the time the cauliflower plant enters the initiation phase of the flower, it is sufficient to obtain shade from sweet corn so that the air temperature in the canopy of the cauliflower plant becomes lower (Figure 4). The cauliflower crop is very sensitive to climate variability, to enter the initiation phase of the flower requires a lower temperature than the vegetative phase [17].

The fulfillment of light and temperature requirements in accordance with the growth stage of cauliflower plants will increase the success of cauliflower planting in hot temperature areas. Explaining the condition of temperature, availability of water and sunlight during vegetative growth, especially when entering the flowering initiation phase significantly affect the cauliflower plants. Suitable environmental conditions will produce mass of flowers with good quality [18]. Setting the distance in a solid sweet corn line that is 20 cm makes some sweet corn leaves cover each other so that it can reduce the intensity of light that reaches the canopy of cauliflower plants. In Figure 3 it is known that as the plant age increases, the amount of sunlight entering the canopy of the cauliflower plant becomes less \( (Y = 1158.15 - 8.19x, R^2 = 0.76) \). The decrease in radiation intensity reaching the canopy of the cauliflower plant will cause a decrease in air temperature Intensity and low temperature will inhibit the growth and yield of cauliflower plants. The heat resistant cauliflower varieties have decreased yield if on entering the period of initiation the flower mass has too low a temperature [15].

Changes in the intensity of light, temperature and humidity above the canopy of cauliflower plants are affected by the time of planting and the distance in the line of sweet corn plants. The rate of temperature change is closely related to radiation intensity above the cauliflower canopy. Figure 5 generally shows a linear relationship, ie an increase in radiation intensity followed by a rise in temperature. The results of linear regression analysis showed that the intensity of radiation affects the temperature above the cauliflower canopy of 91% \( (R^2 = 0.91) \), which means that 90% temperature rise is affected by radiation intensity and 10% is influenced by other factors.

The decrease in air temperature directly affects the air humidity of the cauliflower canopy. The result of linear regression analysis in Figure 6 shows that the temperature has an effect of 85% \( (R^2 = 0.85) \) to the air humidity. Temperature and humidity
have the opposite relationship, ie the higher the air temperature on the canopy of cauliflower plants will cause low humidity, and vice versa. The relationship between relative humidity (RH) and dew point temperature (Td) is exponential up to 50% RH, above which the relationship is linear. From the pooled data of the five sites. All the relationships between RH and Td were exponential with significant coefficients of determination ($R^2$) [19]. Air temperature is closely related to air humidity and greatly affects the growth and flower production of cauliflower plants. Relatively high humidity will help the growth and development of the mass of flowers. At high humidity will result in a larger mass size and more dense so that the mass weight of the interest becomes larger.

**IV. CONCLUSION**

1. The intensity of radiation and air temperature above the cauliflower canopy at monoculture planting is higher than the intercropping system.
2. Arrangements when planting and spacing of sweet corn affect the micro climate behavior on the canopy of cauliflower plants.
3. The microclimate change corresponding to the growth stage of the cauliflower plant was obtained at arrangement when planting sweet corn 2 weeks before planting cauliflower and planting distance in sweet corn line 60 cm, which is able to reduce the intensity of radiation and high temperature so that suitable for cultivation of cauliflower at the intensity and high temperature.

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IA-Automorphisms of a Solvable Product of Abelian Lie Algebras

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Abstract- Let $S$ be a solvable product of class $n \geq 1$ of free abelian Lie algebras of finite rank. In this study we prove that every normal automorphism of $S$ which acts identically on $S'$ is an IA-automorphism.

Index Terms- Free Abelian Lie algebras, solvable product, automorphisms

I. INTRODUCTION

Let $L$ be a Lie algebra over a field $K$ and denote by $\text{Aut}(L)$ the group of automorphisms of $L$. The kernel of a natural homomorphism $\pi: \text{Aut}(L) \to \text{Aut}(L/L')$

consist of automorphisms which act identically modulo $L'$, where $L'$ derived subalgebra. It is called the group of IA-automorphisms and denoted by $\text{IA}(L)$. In [2] it was studied IA-automorphisms of 2-generator metabelian Lie algebras. In [4] it is given the defining relations of the subgroup of IA-automorphisms of a free metabelian Lie algebra of rank 3. In [3] it is investigated generating sets of IA-automorphisms of a free metabelian Lie algebra of rank 3. An automorphism of $L$ is called normal if it fixes every ideal of $L$. The set of normal automorphisms of $L$ is a normal subgroup of the group $\text{Aut}(L)$. Let $F$ be a free Lie algebra of finite rank and $R$ be an ideal of $F$. In [1] it is shown that every automorphism of $F/R'$ which acts identically on $R/R'$ is an IA-automorphism.

For an arbitrary variety of Lie algebras, the solvable product of Lie algebras $F_i$, $i = 1, \ldots, m$ of class $n \geq 1$ is defined as

$$(\prod F_i)/(D \cap F^{(n+1)}),$$

where $F = \prod F_i$ is the free product of the Lie algebras $F_i$ and $D$ is the cartesian subalgebra of $\prod F_i$. If the algebras $F_i$ are non-trivial free abelian Lie algebras then the solvable product of them is isomorphic to $F/F^{(n+1)}$, where $F^{(1)} = [F,F] = F'$ and $F^{(n+1)} = [F^{(n)}, F^{(n)}]$.

Let $S$ be the solvable product of free abelian Lie algebras of finite rank. In this study it is shown that every normal automorphism of $S$ which acts identically on $S'$ is an IA-automorphism.

Let $L$ be a Lie algebra and $E$ any subset of $L$. We show that by $< E >$ the ideal of $L$ generated by the set $E$.

II. IA-AUTOMORPHISMS OF A SOLVABLE PRODUCT

Let $A_i$, $i = 1, \ldots, m$, be free Abelian Lie algebras of finite rank and $F = \prod A_i$ is the free product of the Abelian Lie algebras $A_i$, $i = 1, \ldots, m$. If $S$ is the solvable product of class $n \geq 1$ of the algebras $A_i$, $S$ is isomorphic to $F/F^{(n+1)}$.

Definition 1: Let $L$ be a Lie algebra. An automorphism $\phi$ of $L$ is called a normal automorphism if $\phi(I) = I$ for every ideal $I$ of $L$.

Definition 2: Let $L$ be a Lie algebra. The kernel of a natural homomorphism $\pi: \text{Aut}(L) \to \text{Aut}(L/L')$

consist of automorphisms which act identically modulo $L'$, where $L'$ derived subalgebra. It is called the group of IA-automorphisms and denoted by $\text{IA}(L)$.
Theorem : Every normal automorphism of $S$ which acts identically on $S'$ is an IA-automorphism.

Proof : Let $\phi$ is a normal automorphism of $S$ acting identically on $S'$. Now consider the automorphism $\bar{\phi}: S/S' \to S/S'$ defined as $\bar{\phi}(a+S') = \phi(a) + S'$. $\phi$ is well defined since $\phi$ is a normal automorphism of $S$. Let $P = I/S'$ be an ideal of $S/S'$, where $I$ is an ideal of $S$. Since $\phi(I) = I$ we get

$$\phi(P) = \bar{\phi}(I/S')$$
$$= \{\phi(a+S'): a \in I\}$$
$$= \{\phi(a) + S': a \in I\}$$
$$= I/S'$$
$$= P.$$ 

Hence $\bar{\phi}$ is a normal automorphism of $S/S'$. Since $S/S'$ is finitely generated there is a basis $\{v_1, \ldots, v_l\}$ of $S/S'$. The normal automorphisms of $S/S'$ are linear maps which preserve the vector subspaces of $S/S'$. We now consider the vector subspace $Kv_i$. Since $\bar{\phi}(Kv_i) = Kv_i$ we get that $\bar{\phi}(v_i) = \alpha_i v_i, 0 \neq \alpha_i \in K$, $1 \leq i \leq l$. Similarly, $\bar{\phi}(v_i + v_j) = \alpha_i v_i + \alpha_j v_j = \alpha(v_i + v_j), 0 \neq \alpha \in K, i \neq j$. Thus, $\alpha_i = \alpha_j = \alpha$ and we have $\bar{\phi}(v) = \alpha v$. The algebra $S$ can be considered as $S = F/F^{(n+1)}$. Let denote by $\bar{v} = v + F^{(n+1)}$, where $v \in F$. Then there exist $u_i \in F', 1 \leq i \leq m$, such that

$$\phi(\bar{a}_i) = \alpha \bar{a}_i + \bar{u}_i$$

where $a_i \in A_i$. Let $\bar{w}$ be an element of $S'$. Since $\phi$ acts identically on $S'$ then we have

$$\phi([\bar{w}, \bar{a}_i]) = [\bar{w}, \bar{a}_i]$$

and

$$[\bar{w}, \alpha \bar{a}_i + \bar{u}_i] = [\bar{w}, \bar{a}_i]$$

and

$$(\alpha - 1)[\bar{w}, \bar{a}_i] + [\bar{w}, \bar{u}_i] = 0.$$ 

Then we get $\alpha = 1$ and $\phi$ is an IA-automorphism.

References


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The Expansion of Chinese Businesses in Ghana: Implications for Ghana's Economic Development

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Abstract: Chinese businesses in Ghana span both the formal and informal sectors of the economy. The Ghana Investment Promotion Centre (GIPC) estimates that there were about 800 Chinese companies operating in Ghana. The direction of the implications of Chinese enterprises on Ghana’s development prospects is ambiguously determined. This paper examines the implications of Chinese enterprises operating in Ghana, on Ghana’s economic development. Using data from the Ghana Investment Promotion Council, the economic growth, and poverty and income inequality models are employed to examine the relationship between Chinese enterprises and economic growth in Ghana. The results revealed that Chinese enterprises play a significant role in stimulating economic growth and development in Ghana. The influx of Chinese Enterprises has various benefits to Ghana’s economy including the inflow of technology, promoting export and improving human resource quality.

KEYWORDS: China, economic growth, Enterprises, Ghana, Ghana Investment Promotion Council

1. INTRODUCTION

China is increasingly referred to as the world’s emerging giant among emerging economies, represents the second largest economy in the world, and fastest growing economy in the world; growing at three times faster than the world’s average (Korukonda, 2007). China’s growth and its capacity to move in thirty years from under-development and extreme poverty to an emerging global power and one of the largest exporter of manufactured goods has attracted the attention of many developing countries. A study by Renard (2011), shows China has served as a development model for Africa and an alternative source of trade and finance from Africa’s traditional development partners. The impact of China on African economies has been diverse, depending in part on the sectoral composition of each country’s production. His study indicates that overall, China’s increased engagement with Africa could generate important gains for African economies. However, analysis is required to quantify the advantages and disadvantages, and to design the policies necessary to maximize the development impact of China. One overriding consideration is that reaping the full benefits from Chinese trade and investment will require substantial improvements in governance in African economies (Renard, 2011).

The past decades have witnessed an increasing presence of Chinese Enterprises in countries in Sub-Saharan Africa and Ghana is not an exception. Until about 15 years ago, China’s capital flow to Africa was almost all government-aid related. According to the Ministry of Commerce (MOC), China saw only a negligible amount of $56...
million direct investment in the continent by 1996; this number jumped to $1.5 billion by 2005, and again multiplied 10 times to nearly $15 billion by 2011. Most noticeably, just as the world FDI outflow nosedived following the 2008 financial crisis, China’s overseas investment more than doubled in 2008, with the part going to Africa actually more than tripled that year and increasing steadily thereafter (Shen, 2015). The Ghana Investment Promotion Centre (GIPC) estimated that there were about 800 Chinese companies operating in Ghana (2016). According to this data, approximately 85% were privately owned. The majority of the Chinese private firms in Ghana are SMEs.

Whilst some scholars (Tsikata, Fenny & Areyetey, 2008; Quartey et al, 2008) believe the Chinese state and private firms’ presence in Ghana potentially delivers a number of benefits to the Ghanaian economy, others (Tull, 2006; Trofimor, 2007; Bello, 2007 and Malone, 2008) believe that the presence of these Chinese enterprises and the increasing volume of Chinese trading activities which leads to the importation of cheap products like frozen chicken, textiles, electronic products unto the Ghanaian also impacted negatively on the economy. Thus, the direction of the implications of Chinese enterprises on Ghana’s development prospects is ambiguously determined. It is against this background that this paper examines the implications of Chinese enterprises operating in Ghana, on Ghana’s economic development.

To be able to achieve this objective, the paper is in the following form. The next section provides an overview of Ghana-China diplomatic and economic relations, followed by Chinese businesses operating in Ghana: their characteristics and strategies, literature review, methods used, the discussion of results and conclusion.

1.1 Overview of Ghana-China diplomatic and economic relations

Relations between the two countries date back to 1960 when the countries first established diplomatic relations (https://en.wikipedia.org/wiki/China–Ghana relation). Since then Ghana has provided substantial diplomatic support to the Peoples Republic of China (PRC) with the PRC reciprocating with material support for Ghana's development. In the 1960s President Nkrumah lobbied for the PRC’s reinstatement in the United Nations. Nkrumah also supported the PRC during the Sino-Indian War in 1962. In the early 1990s China built Ghana's National Theatre as a reward for Ghana's diplomatic support during the Tiananmen Square protests in 1989. After Kufuor was elected president of Ghana in 2001 the PRC gave Ghana a US$2.4 million grant to renovate the theatre (Idun-Arkhurs, 2008) The Beijing Summit and the Third Ministerial Conference of the Forum on China-Africa Cooperation (FOCAC) held from November 3 to 5, 2006 served to broadly outline the cooperation agreements that China has or aims to have with African countries, including Ghana. Cooperation agreements between China and Ghana cover a wide range of areas including diplomatic and economic.

1.1.1 Diplomatic relations

In the area of diplomatic cooperation, the two countries have agreed to support each other in issues concerning sovereignty and territorial integrity. The most important facet of this agreement is Ghana’s continued adherence to the “One China Policy” which sees Taiwan as an inalienable part of People’s Republic of China. This agreement forms the basis of all bilateral cooperation since China refuses to maintain diplomatic (as well as economic) ties with any country
that recognizes Taiwan as an independent nation. China and Ghana have also agreed to explore means of greater cooperation in the United Nations, World Trade Organization and other international and regional organizations.

1.1.2 Economic relations

Soon after the established diplomatic relations in 1960, bilateral relations began soon afterwards. Ghana received its first concessional loan from China in 1964 for an amount of US$12 million. Tsikata, Fenny, and Aryeetey (2008) indicate that, over the course of subsequent decades, up till the present, Ghana has received aid from China in various forms for several purposes. The overwhelming majority of these projects have been concerned with infrastructure development.

According to Tsikata et al (2008), aid from China to Ghana has been generally in three forms: loans, grants and technical assistance. The loans have taken the form of either interest-free or interest subsidized preferential loans (concessional loans) granted by the Chinese government through the Ministry of Commerce. Until recently, there was relatively not much activity with regards to the granting of loans. Nevertheless, the ceiling on concessional loans reached a value of 150 million yuan ($18 million) in 1995. In 1995, the full amount of $18 million in concessional loans was granted to be used to promote joint ventures between Ghanaian and Chinese companies.

In 2006, this ceiling on concessional loans was raised to 250 million yuan ($30 million). This entire amount was granted to the Ghana government to be used to fund the first phase of the National Communications Backbone Network Project to be implemented by the Ghana Ministry of Communications.

In 2007, the Chinese government provided Ghana with an aid package for the construction of the Bui Hydro-Electric Power Dam consisting of $270 million in concessional loans and a $332 million buyer credit facility. The buyer credit facility is from the China Exim bank and is at a semi-commercial interest rate. The concessional loans are at an even lower interest rate. This project, like most others funded by the Chinese government, is to be executed by a Chinese company, this time the Sino-Hydro Corporation.

In 2002, an agreement was reached for the Chinese government to provide Ghana with an interest-free loan of $30 million for the construction of the 16.9 kilometer Ofankor-Nsawam section of the Accra- Kumasi road which was completed and commissioned in 2006. In 2004, China gave Ghana a 20 million yuan grant and a 20 million yuan interest-free loan. In 2006, the grant amount was for 20 million yuan grant and the interest-free loan was for 30 million yuan. These and other aid packages have been put to diverse uses.

Technical cooperation is another way by which China gives aid to Ghana (Tsikata et al, 2008). This has primarily taken the form of infrastructure development and has included such projects as the National Theatre, an agricultural cooperation project, the construction of a rice-grinding mill, the Afebi Irrigation Project and grain depot, the Nobewam Farmland Irrigation Project and the Ghana Vocational and Technical Training Centre. China has also provided Ghana with cotton-textile machinery and methane gas equipment. In the area of human resources development, the Chinese government has over the years granted scholarships to Ghanaians.
to study in China and has also organized training courses and seminars. In 2006, more than 300 Ghanaian professionals and bureaucrats benefited from training programs and seminars. The number of Chinese scholarships also doubled from 20 to 40.

1.2 Chinese Enterprises operating in Ghana.

Chinese businesses in Ghana consist of those in the formal and informal sectors of the economy. The formal sector comprises both Chinese state-owned enterprises and privately-owned multinational corporations (Jiao and spring 2008). Estimates regarding the number of Chinese enterprises in Ghana vary considerably. In 2016 most of the Chinese state-owned enterprises were into execution Government of China sponsored projects mostly in the construction sector. Mention can be made of Bui Hydro dam constructed by Sino Hydro (Chinese state-owned hydropower engineering and Construction Company) and the Atuabo Gas Plant built by Sinopec. The Ghana Investment Promotion Centre (GIPC) estimated that there were about 800 Chinese companies operating in Ghana (2016). According to this data, approximately 85% were privately owned and the majority are SMEs. These enterprises are highly flexible and adapt quickly to local conditions. Chinese enterprises are springing up all over the country particularly the southern belt with their scope of investment spanning mining, agriculture, forestry, food processing, fishing, furniture manufacturing, footwear, textiles and garment making, and pharmaceuticals. A great deal of them is also engaged in the trading sector, dealing in manufactured goods and consumables by setting up wholesale and retail shops. Most of the Chinese firms in Ghana are strongly supported by the Chinese state, which gives them the edge over other competitors. As support to Chinese businesses, the Bank of China lunched a “Chinese Desk”, a financial cooperation between the Bank of China and Ecobank to serve Chinese businesses by providing safe, convenient and efficient financial services to them (MOC, 2011). The Chinese businesses do not operate like conventional profit-maximizing firms, often willing to provide concessions in order to gain access to markets. Kamwanga and Koyi (2009), asserts that, some of the practices include bidding at very low prices, settling for low-profit margins, sourcing cheap inputs from China, and using fairly skilled Chinese workers.

2. LITERATURE REVIEW

2.1 Foreign Direct Investment

According to the World Investment Report (2007), Foreign Direct Investment (FDI) is an investment made to acquire a lasting interest in or effective control over an enterprise operating outside of the economy of the investor. The report indicates that, FDI net inflows are the value of an inward direct investment made by non-resident investors in the reporting economy, including reinvested earnings and intra-company loans, net of repatriation of capital and repayment of loans. FDI implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. Such investment involves both the initial transaction between the two entities and all subsequent transactions between them and among foreign affiliates, both incorporated and unincorporated. FDI may be undertaken by
individuals as well as business entities. FDI net outflows are the value of an outward direct investment made by the residents of the reporting economy to external economies, including reinvested earnings and intra-company loans, net of receipts from the repatriation of capital and repayment of loans. These series are expressed as shares of GDP (World Investment Report, 2007).

The motivation of the direct investor is a strategic long-term relationship with the direct investment enterprise to ensure a significant degree of influence by the direct investor in the management of the direct investment enterprise. The "lastinig interest" is evidenced when the direct investor owns at least 10% of the voting power of the direct investment enterprise. Direct investment may also allow the direct investor to gain access to the economy of the direct investment enterprise which it might otherwise be unable to do. The objectives of direct investment are different from those of portfolio investment whereby investors do not generally expect to influence the management of the enterprise (OECD, 2008)

2.2 Economic Development

In contrast to our understanding of economic growth, which is perhaps more dependent on the market, economic development, the product of institutions, and collective action are not as clearly defined (Feldman, 2014). Whereas economic growth is a simple increase in aggregate output, Joseph Schumpeter (1934) in the Theory of Economic Development cited by Feldman (2014), argues that economic development positions the economy on a higher-quality growth trajectory and is achieved through innovation and entrepreneurship.

Kindle Berger and Herrick (1958) cited by Feldman (2014) points out: "Economic development is generally defined to include improvements in material welfare especially for persons with the lowest incomes, the eradication of mass poverty with its correlates of illiteracy, disease and early death, changes in the composition of inputs and output that generally include shifts in the underlying structure of production away from agricultural towards industrial activities, the organization of the economy in such a way that productive employment is general among working age population rather than the situation of a privileged minority, and the correspondingly greater participation of broadly based groups in making decision about the direction, economic and otherwise, in which they should move their welfare".

In the words of Meier (1964), “economic development is a process whereby an economy’s real national income increases over a long period of time”. This definition fails to take into account the changes in the growth of population. If a rise in real income is accompanied by faster growth in population there will be no economic development but retardation. Thus, some economists define economic development in terms of an increase in per capita income. Drewnewski (1966) defines development in terms of economic and social welfare, “In the standard of living of people economic development is supportive and it involves increased per capita income and creation of new opportunities in education, healthcare, employment sectors. Development is of limited significance if it does not lead to economic welfare. Economic development implies increased per capita income and reduced income inequalities and satisfaction of the people as a whole".
2.2.1 Measuring Economic Development

Economic development is a multivariate concept having many dimensions, there is no single measure of development that completely captures the process. Clearly, these indicators or measures of development should be valid and amenable to measurement and comparison. In this paper, per capita income or GDP, Human Development Index (HDI), poverty and inequality are discussed.

2.2.2 Per capita GDP as a Measure of Economic Development

Per capita GDP commonly referred to as per capita income has been one of the earliest and also a popular measure of economic development. It is the mean income of the people which is calculated by dividing the GDP by the total population. The per capita GDP is important because it is a direct measure of living standards and social welfare of the citizens. It is used in making a comparison between two countries. The higher GDP per capita is an indicator for a developing economy in general. In the words of Meier and Baldwin (1964), "an increase in national income may be suggested as the most relevant, as well as most convenient, a single measure of development for both poor and rich countries". In spite of the merits, there are some limitations of the measure some of which are illustrated as follows: Subjective elements are not measured by per capita income. For example, it does not tell us about the availability of happiness, justice, security, freedom, or leisure to the society and for measuring the well-being of people. GDP also excludes income inequality between the rural-urban areas. As for long-term economic development, income inequality is suggested as an important factor without reduction of which economic development would not be possible.

2.2.3 Human Development Index (HDI)

Invented by Lord Meghnad Desai and Nobel Laureate Amartya Sen and launched by Mahbubul-Haq, a leading Pakistani economist. The HDI is a composite index of three social indicators: life expectancy, adult literacy and years of schooling. It also takes into account real GDP per capita. Thus the HDI value of a country is calculated by taking three indicators Longevity, Educational attainment and a decent standard of living. HDI ignores other indicators of human development such as infant mortality, nutrition etc. and it measures relative rather than absolute human development. Human development index ranges from 0.897 in high human development countries while for low human development countries it is 0.436

2.2.4 Poverty

Nobel Prize-winning economist Amartya Sen (2000) has eloquently argued that development can be seen as a "process of expanding the real freedoms that people enjoy." Conversely, poverty is the lack of those freedoms, and is a multifaceted phenomenon. Nonetheless, Karnani (2017), asserts that income is very important, perhaps the single most important, measure of poverty. Poverty is therefore most often measured in monetary terms and defined as consumption below a certain benchmark. There is no objective benchmark, and measures of poverty necessarily entail subjective judgment Karnani (2017). This view is also held by the World Bank in a book on poverty and income distribution in
Latin America when it stated: “any poverty cut-off will reflect some degree of arbitrariness due to the subjectivity of how poverty is defined” (as cited in Boltvinik, 1998)

Poverty is a social phenomenon prevalent in society in which necessities of a large section of the population are not fulfilled. It exists all over the world. There are two concepts of poverty, relative and absolute: The concept of relative poverty can be measured in terms of distribution of income or consumption expenditure, and it is useful for developed countries only where there is no absolute poverty. The concept of absolute poverty is related to the minimum level of living and can be measured in terms of income and consumption expenditure. For the measurement of poverty, consumption is considered as more suitable than income. Absolute poverty is prevalent in less developed countries and is of significant dimensions, hence of concern to the country concerned. The absolute poverty can be indicated in terms of intake of essential food like cereals, pulses, milk, vegetables, and butter or calculated in terms of calorie intake. It is income or expenditure level that can sustain or maintain a minimum standard of living. Life expectancy, infant mortality rate, literacy, nutrition, access to primary school, health clinic and drinking water are the important factors giving appendix information of poverty.

2.3 Theoretical Review of the Nexus between FDI and Economic Development

Classical theory is of the view that foreign direct investment plays important role in economic growth of the host countries (Lensink & Morrissey, 2001, and Gorg & Strobl, 2002, Nabila, Samia, & Hafeez, 2011, Oyatoje et al., 2011). According to the theory, FDI through positive spillover, competition, and imitation enhance the transfer of capital, technology, and skills to the host countries (Mody, 2004, and Gao, 2005). Also, through backward and forward linkage FDI will lead to improved balance of payments, boost the gross national income, enhance improvement in infrastructure and increases the production for export (Gorg et al., 2001, Girma et al., 2003, Li & Liu, 2005, Chakraborty & Nunnenkamp, 2008, and Obida & Nurudeem, 2010).

Dependency theory did not believe on the assumption that FDI is vital for the economic growth of developing countries. The theory posits that FDI strangulate development by displacement of indigenous production and perpetuates dominance of the weaker countries by keeping them in a position of constant dependence on the economies of the developed countries (Alfaro, 2003; UNCTAD, 1999, Gorg & Strobl, 2002, and Girma & Wakelin, 2000; Mercinger, 2003; and Bello & Adeniyi, 2010).

New growth theory or endogenous theory sees the level of technology as a driving force for a long run economic growth in any economy. According to the theory, knowledge and technology result to increase in return which leads to increase in economic growth (Cortright, 2001). In production function, Meier and Rauch (1995) pointed out that human capital investment contributes to increase in return while De Casto (1998) put it that the level of research and development in an economy will determine the rate of innovation and economic growth of the country. By augmenting domestic capital and incorporation of diffused foreign technologies in the production function of the host countries,
foreign direct investment will be seen as responsible for the increase in economic activities in the host economy (Shanet.al, 1997).

2.4 Empirical Review of FDI and Economic Development

Previous empirical studies have divergent views on the role FDI in enhancing economic growth. Some of these studies such as Magnus and Fosu (2007) used Toda-Yamamoto and Granger causality on annual data range of 1970 to 2001 to analysis FDI as it affects pre and post SAP economic growth of Ghana. The results of the study failed to establish the evidence of causality between FDI and economic growth for the whole period and pre-SAP period. Also, the result indicated that FDI granger caused economic growth within the post-SAP period.

Adjaye (2009), examined the relationship between FDI and GDP growth in Ghana using annual time series data covering 1970 to 2007. The Johansen and Juselius (1990), multivariate maximum likelihood procedure was employed. The study established a positive and significant relationship between FDI and growth. The Granger causality tests confirmed a bidirectional causality running from foreign direct investment to growth. Frimpong et al., (2011) disagreed with Adjaye when they used the Toda and Yamamoto (1995) to explore the causal link between FDI and growth in Ghana using annual time series data from 1970 to 2002. The results revealed that there is no directional causality between FDI and economic growth for the total sample period and the pre-SAP period. However, they discovered a unidirectional causality from FDI to growth during the post SAP period. The conflicting results could be due to the difference in estimation techniques used. Whereas Adjaye engaged the Johansen and Juselius (1990) multivariate maximum likelihood procedure, Frimpong et al., employed the Toda and Yamamoto (1995) to examine the causal linkage between FDI and growth.

In addition, Sackey et al., (2012) employed various econometric tools such as Augmented Dickey-Fuller tests, Vector Auto Regression and Johansen co-integration test to study the effect of the foreign direct investment on economic growth of Ghana using time series data from 2001 to 2010. They established a positive and significant long-run relationship between FDI and growth and a uni-directional causality running only from FDI to GDP growth in Ghana.

Furthermore, Antwi et al. (2013) used annual time series data from Ghana for the period 1980 to 2010. They employed simple ordinary least square regressions and confirmed a positive and statistically significant relationship between FDI and growth. However, the study failed to check for directional causality between the two variables.

Similarly, Edoumiekumo (2009) employed the Johansen cointegration approach to investigate the relationship between foreign direct investment and economic growth in Nigeria using annual time series data covering the period 1970 to 2007. The study established a positive and significant link between foreign direct investment and growth. The Granger causality test also confirmed a bidirectional causality running from foreign direct investment to grow. Ogiagah et al. (2010) as well used the Johansen cointegration approach and the Granger Causality test to consider the linkage between FDI and GDP growth in Nigeria using annual time series data from 1970 to 2007 of the Sub-Sahara Africa Region. The study revealed a positive and significant long-run relationship between FDI and GDP growth and a uni-directional causality running from GDP to FDI.

Nabila et. al (2011) employed heterogeneous panel techniques on annual data for the periods of 1983-2008 to examine the impact of foreign direct investment on economic output of selected Asian countries. The Larsson panel test
shows evidence that foreign direct investment and economic growth are co-integrated. FMOLS posited that FDI has a positive significant impact on economic growth. The panel homogeneous causality shows that foreign direct investment and output Granger cause each other but non-causality test affirms evidence of uni-directional causal relationship run from foreign direct investment to output of the selected economies. In the case of Malaysia, the test exhibits that foreign direct investment and growth have two-way causation. The results show that foreign direct investment Granger the economic growth of Thailand, Singapore, Nepal, and Japan while in Sri-Lanka, Pakistan and Bangladesh economic growth Granger cause foreign direct investment. Finally, the study did not show any causation in the case of Singapore, China, and the Maldives, Korea Democratic, Indonesia, Philippines, and India. In a similar study in selected African and Asian countries, Abdullahi, Alierio, and Yusuf (2012) and Gaurav and Mohd (2011) reveal that FDI positively impacts on economic growth in African and Asian countries. The study also reported a one-way relationship from FDI to economic growth only in Africa.

The literature presents mixed results on the links between FDI and growth. Most of the empirical studies are based on cross-sectional and panel data. The cross-country and panel data studies normally average the data over the samples used and across countries from different regions. As a result, they may not reveal a true nature of the relationship between Inflation FDI and growth. Such studies are not country specific.

Im and McLaren (2015) investigated the effects of inward FDI on income distribution and the poverty rate in developing countries using panel data. The study addressed the problem of endogenous FDI through time-varying instruments based on shocks to the attractiveness of investment in neighboring countries as well as oil discoveries in the host country. Without instruments, FDI appears to have no effect on income inequality and a small positive effect on poverty, but with the instruments, in contrast to previous findings, we find that FDI helps decrease both inequality and the poverty rate in the host country.

Koc (2012) study aimed at determining the effects of Foreign Direct Investment (FDI) on the level of poverty in developed and developing countries. The panel regression method, which covers 40 countries’ income distribution data, is employed. The results show that the poorest segments receive a lower share of the income created by FDI than the richest segments of these countries, indicating that FDI does not have a serious contribution to poverty reduction. FDI affects the income levels of different income groups in every country, however, there is not a uniform effect in the countries examined.

3. METHODS

This section of the paper outlines the methods that were followed to achieve the objectives of the paper. It includes model specification of economic growth model as well as poverty and income inequality models. The sources of data and method of estimation of the three models are also outlined in this section

3.1 Conceptual Framework and Methodology of Chinese FDI and Economic Growth of Ghana
To examine the relationship between Chinese Enterprises (FDI) and economic growth, this paper presents the theoretical model within the framework of the neoclassical endogenous growth model (Barro and Sala-i Martin 1995; Romer, 1986, 1990, 1994).

Starting with the neoclassical production, the production function is specified as follows:

\[ Y = AF(K, L) \]  

where \( Y \), \( A \), \( K \), and \( L \) denote the level of output, level of technical progress, the stock of domestic capital and labour respectively.

The advent of endogenous growth theory has opened the way by which policy can influence growth and for that matter FDI (De Mello 1997; Borensztein et al. 1998). De Mello (1997) has provided extensive transmission mechanisms through which FDI affects growth in an economy. Thus, the paper augments the production function by including FDI.

The augmented production function is specified below

\[ Y = A F(K, L, Chfdi) \]  

\( Chfdi \) denotes foreign direct investment flow from China to Ghana which is used as a proxy for Chinese Enterprises and the other variables (\( A \), \( K \), \( L \), and \( F \)) are as previously defined.

The study assumes that production function takes Cobb-Douglas form with constant returns to scale.

\[ 2^\alpha_1 1^\alpha_2 2^\alpha_3 1^\alpha_4 \]  

In most of the cross-sectional and panel empirical studies on economic growth (see for instance Barro 1996; Omri and Kahouli 2014), output per capita, rather than the aggregate output is employed in order to account for differences in population across countries. Thus, equation (3.3) is transformed to obtain the per capita output function.

\[ \frac{Y}{L} = AK^{\alpha_1} (Chfdi)^{\alpha_2} L^{1-\alpha_1-\alpha_2} \]  

\[ \frac{Y}{L} = AK^{\alpha_1} (Chfdi)^{\alpha_2} L^{\alpha_1} L^{-\alpha_2} \]  

\[ \frac{Y}{L} = A \left( \frac{K}{L} \right)^{\alpha_1} \left( \frac{Chfdi}{L} \right)^{\alpha_2} \]  

Denoting \( \frac{Y}{L} \) by \( y \), \( \frac{K}{L} \) by \( k \), and \( FDI \) by \( fdi \) and inserting these variables in equation (3.6) gives equation (2.7)

\[ y = Ak^{\alpha_1} Chfdi^{\alpha_2} \]  

Taking natural logarithm and the time derivative of each variable yields growth rate of output per capita function.

\[ \frac{Lny}{A} = \alpha_1 \ln k + \alpha_2 \ln Chfdi \]  

\[ \frac{\dot{y}}{y} = \frac{\dot{A}}{A} + \alpha_1 \frac{\dot{k}}{k} + \alpha_2 \frac{\dot{fdi}}{fdi} \]  

Let \( g_y = \frac{\dot{y}}{y} \) \( g_k = \frac{\dot{k}}{k} \) \( g_{fdi} = \frac{\dot{fdi}}{fdi} \) \( g_A = \frac{\dot{A}}{A} \)
Making the relevant substitutions, equation (3.10) is derived

\[ g_y = g_A + \alpha_1 g_k + \alpha_2 g_{chfdi} \]  \hspace{1cm} (3.10)

Equation (3.1) simply shows that growth rate of output per capita depends on the growth of capital stock and growth rate of Chinese foreign direct investment per capita which is a proxy for Chinese Enterprises. It is expected that the presence of Chinese Enterprises in Ghana is associated with productivity spillovers which results in increasing returns in domestic production. Also, the presence of Chinese Enterprises is expected to add to existing stock of knowledge in the recipient economy through labour training and skill acquisition and diffusion, on one hand, and through the introduction of alternative management practices and organisational arrangements (De Mello 1997).

To control for other variables that affect economic growth, this paper follows the methodology employed by Omir and Kahouli (2014), who focused on the determinants of the growth rate of factor productivity. The factor productivity equation is specified below:

\[ g_y = \beta_0 + \beta_1 g(HC) + \beta_2 (CPI) + \beta_3 (OPEN) + \beta_4 (GOV) + \varepsilon \]  \hspace{1cm} (3.11)

where HC is human capital proxied by primary school enrolment, CPI represents the percentage change in consumer price index used here to measure inflation, OPEN is trading openness/GDP and GOV as government expenditure/GDP ratio

Substituting equation (3.11) into equation (3.10) gives equation (3.12)

\[ g_y = \gamma_0 + \gamma_1 g_{chfdi} + \gamma_2 g_k + \gamma_3 g(HC) + \gamma_4 (CPI) + \gamma_5 (OPEN) + \gamma_6 (GOV) + g_y - 1 + \varepsilon \]  \hspace{1cm} (3.12)

Due to the time frame of the study, the study focused on four key explanatory variables for the growth model. Thus, equation (3.12) is modified to include only four explanatory variables.

\[ g_y = \gamma_0 + \gamma_1 g_{chfdi} + \gamma_2 g_k + \gamma_3 g(HC) + \gamma_4 (CPI) + \varepsilon \]  \hspace{1cm} (3.13)

The variables in the model including the education which refers to primary school completion as a percentage of relevant age group, GDP per capita, GDP per capita growth, capital formation defined as additions to the fixed assets of the economy plus net changes in the level of inventories and inflation which is measured as the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services were all extracted from World Bank’s Development Indicators from 1990 to 2016. Data on China’s foreign direct investment to Ghana were extracted from Ghana Investment Promotion Centre database.

To estimate equation (3.13) the study used Ordinary Least Squares for the estimation of the growth model.

3.2 The methodology of Poverty and Income Inequality Models.

The paper followed the methodology of Park and Mecado (2015) to develop the poverty and income inequality models. The poverty model is specified below
\[ Pov = f(\text{ruleoflaw}, \text{education}, \text{literacy}, \text{inflation}, \text{financialinclusion}, \text{growth}) \] ............ (3.14)

It is expected that the inflow of foreign investment from China to Ghana will help reduce the poverty rate in Ghana if the package of the FDI is labour-intensive which creates employment opportunities for indigenous thereby reducing poverty level Tambunan (2005). Thus, equation (3.6) is modified to account for the role of Chinese enterprises in the reduction of the poverty rate in Ghana.

\[ Pov = f(\text{chfdi}, \text{ruleoflaw}, \text{education}, \text{literacy}, \text{inflation}, \text{financialinclusion}, \text{growth}) \] ........ (3.14)

Due to the time frame of the study, the paper is constraint with degrees of freedom, thus the paper reduces the number of explanatory variables in the poverty model from seven to four key explanatory variables. These include Chinese enterprises, rule of law, education and economic growth.

\[ Pov = \beta_0 + \beta_1 \text{chfdi} + \beta_2 \text{ruleoflaw} + \beta_3 \text{education} + \beta_4 \text{growth} + \nu_i \] ...................... (3.15)

The income inequality model is specified below

\[ \text{inequality} = \beta_0 + \beta_1 \text{chfdi} + \beta_2 \text{ruleoflaw} + \beta_3 \text{education} + \beta_4 \text{growth} + \beta_5 \text{literacy} + \varepsilon_i \] … (3.9)

Data on Poverty rate defined as mean shortfall from the poverty lines (counting the nonpoor as having zero shortfall) as a percentage of the poverty lines, top 10 percent income and bottom 20 percent income group and literacy rate defined as the percentage of people ages 15 and above who can, with understanding, read and write a short, simple statement on their everyday life were extracted from World Bank’s Development Indicators from 1990 to 2015. The study used Palma ratio defined as the ratio of top 10 percent income group to bottom 20 percent income group to measure income inequality. Data on rule of law was extracted from Mo Ibrahim Governance data from 2000 to 2015.

To estimate the poverty and income inequality models, the study employed Ordinary Least Squares to conduct the estimation of the poverty and income inequality models.

4. DISCUSSION OF RESULTS

This section discusses the empirical results that relate to the objectives of the paper. It includes the discussion of the trend of China’s Foreign Direct investment inflow in Ghana, and the effects of Chinese Enterprises on economic growth, poverty and income inequality in Ghana.

4.1 The trend of the Flow of China's Foreign Direct Investment to Ghana

This sub-section discusses the time profile of foreign direct investment from China to Ghana from 1990 to 2016. Figure 4.1 shows the trend results.
Figure 4.1. Trend of Foreign Direct Investment of Chinese Enterprises in Ghana

Source: Author’s compilation based on data obtained from Ghana Investment Promotion Council

Figure 4.1 shows that there is a marginal steady increase of Chinese Investment to Ghana from 1990 to 1995. It increased from $325,006 in 1990 to $727,014.1 in 1995. However, there was a sharp increase in the amount of foreign direct investment (FDI) from China to Ghana from 1995 to 1996. The amount increased from $727,014.1 in 1995 to $1,602,475 in 1996. This could be due to the strengthening of democracy in Ghana in the mid-90s, therefore, making it attractive for foreign investment to flow into the country and for that matter the investment inflows from China. The investment flows from China to Ghana was unstable between 1996 and 2002. It declined between the periods 1996 and 1997 and then increased from 1997 to 1999 and declined from that year to 2000. This unstable trend continued until 2002. Ghana enjoyed a steady increase in the inflow of foreign direct investment from 2002 to 2007. The amount of FDI from China to Ghana increased from $1,192,364 in 2002 to $12,343,936 in 2007. The year 2007 recorded the highest foreign direct investment inflow from China to Ghana across the 27 year period. However, there was a sharp declined in the inflow of foreign direct investment from China to Ghana from 2007 to 2008. This could be attributable to the financial crisis that hit most countries in the world. This compelled most countries during this period to focus on internal or domestic affairs rather than transferring capital from the domestic economy to a foreign economy. This declining trend continued till 2010. It then started to increase marginally from the year 2010 to 2016.

4.2 Effect of Chinese Enterprises on Economic Growth of Ghana

This sub-section discusses the empirical results that relate to the effects of Chinese Enterprises on economic growth of Ghana. Table 4.2 shows these empirical results.
Diagnostic Test

The reliability of OLS regression is based on satisfying some key assumptions of the regression model. A failure of any of the key assumptions renders the interpretation of the OLS regression unreliable. Thus, this section present diagnosis test results on the OLS regression estimated for the economic growth model. These include heteroscedasticity, normality, and autocorrelation tests. The results are presented in Table 4.1.

**Table 4. 1. Results of Diagnosis Test**

<table>
<thead>
<tr>
<th>Diagnosis Test</th>
<th>Chi-square Test</th>
<th>Probability value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heteroscedasticity</td>
<td>2.994363</td>
<td>0.5588</td>
</tr>
<tr>
<td>Normality</td>
<td>2.22</td>
<td>0.3288</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>3.237130*</td>
<td>0.0864</td>
</tr>
</tbody>
</table>

Source: Author’s computations based on data obtained from Ghana Investment Promotion Council, World Development Indicators and Imo Ibrahim Governance Data

The results revealed that there is no heteroscedasticity in the growth regression model and the residuals from the regression model are normally distributed. The results also indicate that the residuals from regression are autocorrelated. Thus the revelation by the diagnostic test results indicates that there are problems with least squares estimation and least squares estimate is likely to be inefficient. To resolve this problem, the paper adopted Newey-West standards errors also known as heteroscedasticity and autocorrelation-consistent standard errors (HAC) estimate to correct for the autocorrelation.

Table 4.2 shows the F-statistic from the HAC estimate is statistically significant at the 1 percent level of significance. This implies that the presence of Chinese Enterprise, physical capital, education, and inflation are jointly significant in explaining the changes in growth rate of GDP of Ghana. The R² value also shows that about 97 percent of the variation in economic growth of Ghana proxied by GDP per capita is jointly explained by the presence of Chinese Enterprise, Capital, Education, and inflation.

**Table 4.2. HAC Estimate of the Effects of Chinese Enterprise on Economic Growth in Ghana**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>LnChfdi</td>
<td>0.041252**</td>
</tr>
<tr>
<td></td>
<td>[3.489623]</td>
</tr>
<tr>
<td>Capital</td>
<td>0.004145**</td>
</tr>
<tr>
<td></td>
<td>[2.255342]</td>
</tr>
<tr>
<td>Education</td>
<td>0.015382***</td>
</tr>
<tr>
<td></td>
<td>[16.14458]</td>
</tr>
</tbody>
</table>
Inflation -0.000771
[-1.600385]
Constant 5.142651***
[33.62587]

\[ R^2 = 0.973818 \quad F = 204.5655 \quad (0.00) \quad N=27 \]

**denotes statistically significant at the 5 percent; and *** denotes statistically significant at the 1.

Note: lnChfdi is the natural log of Chinese foreign direct investment

Source: Author’s Computation based on data obtained from Ghana Investment Promotion Council, World Development Indicators and Imo Ibrahim Governance Data

The results also show that an increase in the amount of capital injected by Chinese Enterprises into the economy of Ghana generates a significant effect on the economic growth of Ghana at the 5 percent level of significance. The result is consistent with the one obtained by Sackey et al., (2012) who also established the positive effect of the foreign direct investment on economic growth of Ghana. A percent increase in the amount of capital injected into the economy of Ghana by the Chinese enterprises stimulates economic growth by 0.04 percent. This gives the indication that the presence of the Chinese Enterprises promotes the growth prospects of Ghana. The influx of Chinese Enterprises is not just about transfer of capital but it also comes with various benefits to Ghana including the inflow of technology, promoting export and improving human resource quality which as well augments the economic growth of Ghana (Borenzstein and Lee (1998) and Lim and Maison (2000)). Further to this, domestic firms can attain spillover efficiency only when they are able to absorb the gains that come with the presence of Chinese Enterprises in Ghana. The presence of Chinese Enterprises also has spillover effects on productivity of domestic firms as well as training of labour and management practices (Blomstrom et al 1992 and De Mello 1997). Thus, the influx of Chinese Enterprises works through these transmission mechanisms to stimulate the growth of the Ghanaian economy.

Among the control variables, capital and education which is a proxy for human capital play a significant role in determining per capita GDP of Ghana. The results show that physical capital exerts a significant positive effect on per capita GDP at the 5 percent level of significance. A percentage increase in the stock of physical capital as a percentage of GDP increases per capita income of Ghana by 0.004 percent. Both exogenous and endogenous neoclassical growth literature recognizes the role of capital in stimulating the growth of economies. High level of capital stock improves labour productivity and therefore increases economic growth. The results also show that human capital proxied by education exerts a significant positive effect on economic growth at the 1 percent level of significance. A percentage increase in primary school enrolment increases per capita income by 0.02 percent. As it is recognized in growth literature, human capital is one of the key factors for the growth of economies. Improvement in human capital implies an improvement in labour skills which stimulates productivity in the production process. Further to this, educated workers are more proficient at learning and responding to new information and technology.

Finally, inflation as a control variable in the growth model plays a negligible role in determining the economic growth of Ghana even at the 10 percent level of significance.
4.3 Effect of Chinese Enterprises on Poverty Reduction in Ghana

This sub-section discusses the empirical results that relate to the effects of Chinese Enterprises on poverty reduction in Ghana. Table 4.4 shows these empirical results.

Diagnosis Test

This section discusses the diagnostic test results on the ordinary least squares estimation. This includes heteroscedasticity, normality, and autocorrelation tests. The results are presented in Table 4.3.

Table 4.3. Results of Diagnosis Test

<table>
<thead>
<tr>
<th>Diagnosis Test</th>
<th>Chi-square Test</th>
<th>Probability value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heteroscedasticity</td>
<td>8.452826*</td>
<td>0.0763</td>
</tr>
<tr>
<td>Normality</td>
<td>1.94</td>
<td>0.3784</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>10.27330***</td>
<td>0.0013</td>
</tr>
</tbody>
</table>

Source: Author’s computations based on data obtained from Ghana Investment Promotion Council, World Development Indicators and Imo Ibrahim Governance Data

The results revealed that there is heteroscedasticity in the poverty regression model but the residuals from the regression model are normally distributed. The results also indicate that the residuals from regression are autocorrelated. Thus the revelation by the diagnostic test results indicates that there are problems with least squares estimation and least squares are likely to be inefficient. To resolve this problem, the study adopted HAC estimate to correct for the autocorrelation in the poverty regression model. Table 4.2 shows that the F-statistic from the HAC estimate is statistically significant at the 1 percent level of significance. This implies that the presence of Chinese Enterprise, rule of law, education and growth are jointly significant in explaining the changes in the poverty rate of Ghana. The $R^2$ also shows that about 97 percent of the variation in poverty in Ghana is jointly explained by the presence of Chinese Enterprise, rule of law, education, and growth of GDP.

Table 4.4. HAC Estimate of the Effects of Chinese Enterprise on Poverty Reduction in Ghana

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnChent</td>
<td>-2.54E-07***</td>
</tr>
<tr>
<td></td>
<td>[-4.880197]</td>
</tr>
<tr>
<td>Rule of Law</td>
<td>-0.415378***</td>
</tr>
<tr>
<td></td>
<td>[-9.423479]</td>
</tr>
<tr>
<td>Education</td>
<td>-0.050282***</td>
</tr>
<tr>
<td></td>
<td>[-1.751510]</td>
</tr>
<tr>
<td>Growth of GDP</td>
<td>-0.005204</td>
</tr>
</tbody>
</table>
The results also show that an increasing amount of capital injected by Chinese Enterprise into the economy of Ghana exerts a significant negative effect on poverty reduction in Ghana at the 1 percent level of significance. The result is consistent with the one obtained by Im and McLaren (2015) who also found the negative influence of FDI on poverty reduction in developing countries. A dollar increase in the amount of capital injected into the economy of Ghana by the Chinese enterprises reduces poverty by 0.00000025 percent. This gives the indication that the presence of the Chinese Enterprises promotes poverty reduction in Ghana. The influx of Chinese Enterprises is not just about transfer of capital but it also comes with various benefits to Ghanaian including the employment of the masses in their firms which raises the income levels of the poor Ghanaian which makes them break away from the poverty bracket.

Among the control variables, rule of law and education play a significant role in reducing poverty in Ghana. The results show that education exerts a significant negative effect on poverty reduction at the 1 percent level of significance. A percentage increase in primary school enrolment reduces the poverty rate by 0.05 percent in Ghana. Access to education improves the productivity and academic credentials of the poor thereby providing them with the opportunity to have access to jobs that pay well which pushes them out of the poverty bracket. The results also show that rule of law exerts a significant negative effect on poverty reduction at the 1 percent level of significance. Improvement in rule of law limits the level of corruption in the society. The World Bank report also indicated that lack of access to justice is itself central dimension of poverty. Thus improvement in rule of law implies access to justice which benefits the poor.

Finally, economic growth as a control variable in the poverty model plays a negligible role in reducing poverty in Ghana even at the 10 percent level of significance. The implication of the results is that deliberate policy to reduce poverty through economic growth will be futile. Thus, the theory that posits that growth in GDP trickles down to the poor is not a reality in Ghana. The result largely is intuitively plausible. Growth is normally skewed in favour of the few rich people relative to the masses who live in abject poverty. Most of the time growth in the overall economy is driven by the growth in cities relative to the rural community where the majority of the dwellers are poor. This result is supported by the assertion made by Dahlquist (2013) who noted that a country or region with a large fraction of poor and a low growth rate shown to have problems in reducing poverty. Dahlquist (op cit.) further indicated that economic growth does not appear to be sufficient tool when the level of poverty is extreme.

4.4 Effect of Chinese Enterprise on Income Inequality in Ghana
This sub-section discusses the empirical results that relate to the effects of Chinese Enterprise on income inequality. Table 4.6 shows these empirical results.

**Diagnosis Test**

This section discusses the diagnostic test results on the ordinary least squares estimation. This includes heteroscedasticity, normality, and autocorrelation tests. The results are presented in Table 4.5.

### Table 4.5. Results of Diagnosis Test

<table>
<thead>
<tr>
<th>Diagnosis Test</th>
<th>Chi-square Test</th>
<th>Probability value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heteroscedasticity</td>
<td>6.038296</td>
<td>0.3025</td>
</tr>
<tr>
<td>Normality</td>
<td>1.47</td>
<td>0.4788</td>
</tr>
<tr>
<td>Autocorrelation</td>
<td>0.188380</td>
<td>0.6643</td>
</tr>
</tbody>
</table>

Source: Author’s computations based on data obtained from Ghana Investment Promotion Centre, World Development Indicators, and Imo Ibrahim Governance Data

The results revealed that there is no heteroscedasticity in the income inequality regression model and the residuals from the regression model are normally distributed. The results also indicate that the residuals from regression are not autocorrelated. Thus the revelation by the diagnostic test results indicates that OLS estimation is reliable and therefore discussion of OLS regression estimate follows.

The F-statistic from the OLS estimate is statistically significant at the 1 percent level of significance. This implies that the presence of Chinese Enterprise, rule of law, education, literacy rate and growth are jointly significant in explaining the changes in income inequality in Ghana. The $R^2$ also shows that about 99 percent of the variation in income inequality in Ghana is jointly explained by the presence of Chinese Enterprise, rule of law, Education, literacy rate and growth of GDP.

### Table 4.6. OLS Estimate of the Effects of Chinese Enterprise on Income Inequality in Ghana

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chfdi</td>
<td>-4.86E-08**</td>
</tr>
<tr>
<td></td>
<td>[-2.472989]</td>
</tr>
<tr>
<td>Growth of GDP</td>
<td>-0.077570***</td>
</tr>
<tr>
<td></td>
<td>[-4.747966]</td>
</tr>
<tr>
<td>Education</td>
<td>0.046426***</td>
</tr>
<tr>
<td></td>
<td>[4.526744]</td>
</tr>
<tr>
<td>Rule of Law</td>
<td>-0.016720</td>
</tr>
</tbody>
</table>

http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7617
Literacy rate | 0.181603***
| [7.221198]
Constant  | -6.772707
| [-15.54479]

\[ R^2 = 0.992355 \ F = 545.1536 \ (0.00) \ N=27 \]

**denotes statistically significant at the 5 percent; and ***denotes statistically significant at the 1. Note: Chfdi is the Chinese foreign direct investment

Source: Author's Computation based on data obtained Ghana Investment Promotion Council, World Development Indicators and Imo Ibrahim Governance Data

The results also show that an increase in the amount of capital injected by Chinese Enterprises into the economy of Ghana exerts a significant negative effect on income inequality in Ghana at the 5 percent level of significance. A dollar increase in the amount of capital injected into the economy of Ghana by Chinese reduces income gap by 0.00000047. This gives the indication that the presence of the Chinese Enterprises promotes income inequality reduction activities of Ghana. The influx of Chinese Enterprises favours the poor more than middle and high-income individuals in Ghana. Thus, this raises the income levels of the low-income earners thereby closing the income gap between low-income earners and middle and high-income earners in Ghana.

Among the control variables, literacy rate, economic growth, and education exert a significant effect on income inequality in Ghana. The results show that education exerts a significant positive effect on income inequality at the 1 percent level of significance. A percentage increase in primary school enrolment increases income inequality by 0.05 unit in Ghana. This is counterintuitive as one would expect that education will reduce income inequality. Perhaps there is inequality in the access to education reflecting in wide income difference between the haves and have not. The results also show that literacy rate exerts significant effect positive effect income inequality at the 1 percent level of significance. This is also counterintuitive as one would expect that literacy rate will reduce the income gap between the poor and non-poor. Perhaps there are differences in literacy rate between the have and have not thereby reflected in their income levels. The results also show that economic growth exerts a significant negative effect on income inequality at the 1 percent level of significance. This implies that growth in the economy of Ghana is distributed in favour of the poor relative to the non-poor.

Finally, rule of law as a control variable in the income inequality model plays a negligible role in reducing income inequality in Ghana even at the 10 percent level of significance.

5. CONCLUSION AND POLICY IMPLICATIONS

The study examined the effects of Chinese Enterprises on the economic development of Ghana. Specifically, the study looked at the trend of Chinese Enterprises in Ghana, the effects of these enterprises on economic growth, poverty and income inequality in Ghana. The data on GDP per capita, physical capital, primary school enrolment, inflation
measured by consumer price index, economic growth and literacy rate were gathered from World Bank's World Development indicators from 1990 2016. Data on FDI from China were gathered from Ghana Investment Promotion Centre and rule of law data was extracted from Mo Ibrahim's governance data report. HAC estimate was employed to estimate the effects of Chinese Enterprise on economic growth and Poverty in Ghana. OLS was employed to estimate the effect of Chinese Enterprise on income inequality in Ghana.

The results revealed that Chinese enterprises play a significant role in stimulating economic growth of Ghana. The influx of Chinese Enterprises is not just about transfer of capital but it also comes with various benefits to Ghana including the inflow of technology, promoting export and improving human resource quality which as well augments the economic growth of Ghana. The presence of Chinese Enterprises also has spillover effects on productivity of domestic firms as well training of labour and management practices. The control variables such as capital and education also play a significant role in determining the economic growth of Ghana.

The findings also show that Chinese enterprises reduce the level of poverty and income inequality in Ghana. The influx of Chinese Enterprises is not just about transfer of capital but it also comes with various benefits to Ghanaian including the employment of the masses in their firms which raises the income levels of the poor Ghanaian which makes them break away from the poverty bracket. Access to education also reduces poverty in Ghana. Access to education improves the productivity and academic credentials of the poor thereby providing them with the opportunity to have access to jobs that pay well which pushes them out of the poverty bracket.

The results revealed that Chinese enterprises play a significant role in stimulating economic growth of Ghana, reducing poverty rate and income inequality. The paper, therefore, recommends that appropriate policies such as reduction in corporate income tax for foreign firms including Chinese enterprises, stable macroeconomic environment policies should be implemented to continually promote the inflow of Chinese enterprises to the country to continually benefit from their presence in the economic development of Ghana.

The direct relationship existing between enrolment and economic growth in Ghana implies that an increase in enrolment would induce economic growth in the country. It is recommended that policies such as school feeding and capitation grant that increase primary school enrolment should be implemented to stimulate the level of enrolment and completion at the primary school level. The free Public Senior High School education is a step in the right direction. However, the government should also progressively consider the quality side of the provision of free public Senior High School education. Teachers' motivation and logistics to create a conducive environment for studies must also be taken into consideration.

APPENDIX

Dependent Variable: LNGDP_PER_CAPITA
Method: Least Squares
Date: 12/17/17  Time: 04:09
Sample: 1990 2016
Included observations: 27
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed
   bandwidth = 3.0000)

<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>LNCHINAFDI</td>
<td>0.041252</td>
<td>0.011821</td>
<td>3.489623</td>
<td>0.0021</td>
</tr>
<tr>
<td>CAPITAL</td>
<td>0.004145</td>
<td>0.001838</td>
<td>2.255342</td>
<td>0.0344</td>
</tr>
<tr>
<td>EDUCATION_COMPLETION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>__LO</td>
<td>0.015382</td>
<td>0.000953</td>
<td>16.14458</td>
<td>0.0000</td>
</tr>
<tr>
<td>INFLATION__LOG</td>
<td>-0.000771</td>
<td>0.000482</td>
<td>-1.600385</td>
<td>0.1238</td>
</tr>
<tr>
<td>C</td>
<td>5.142651</td>
<td>0.152937</td>
<td>33.62587</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared               0.973818  Mean dependent var  7.013807
Adjusted R-squared      0.969057  S.D. dependent var  0.241687
S.E. of regression      0.042514  Akaike info criterion -3.312388
Sum squared resid       0.039764  Schwarz criterion    -3.072418
Log-likelihood          49.71724  Hannan-Quinn criter. -3.241032
F-statistic             204.5655  Durbin-Watson stat  1.277712
Prob(F-statistic)       0.000000  Wald F-statistic    208.8247
Prob(Wald F-statistic)  0.000000

Breusch-Godfrey Serial Correlation LM Test:

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>Prob. F(1,21)</th>
<th>Prob. F(1,21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.237130</td>
<td>0.0864</td>
<td>0.0864</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>3.606141</td>
<td>Prob. Chi-Square(1)</td>
</tr>
</tbody>
</table>

Heteroskedasticity Test: Breusch-Pagan-Godfrey

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>Prob. F(4,22)</th>
<th>Prob. F(4,22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.686047</td>
<td>0.6092</td>
<td>0.6092</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>2.994363</td>
<td>Prob. Chi-Square(4)</td>
</tr>
<tr>
<td>Scaled explained SS</td>
<td>1.147072</td>
<td>Prob. Chi-Square(4)</td>
</tr>
</tbody>
</table>
Dependent Variable: POVERTY
Method: Least Squares
Date: 12/17/17   Time: 22:25
Sample: 1990 2016
Included observations: 27
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed
    bandwidth = 3.0000)

<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>CHINAFDI</td>
<td>-2.54E-07</td>
<td>5.19E-08</td>
<td>-4.880197</td>
<td>0.0001</td>
</tr>
<tr>
<td>EDUCATION_COMPLETION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>_LO</td>
<td>-0.050282</td>
<td>0.028708</td>
<td>-1.751510</td>
<td>0.0938</td>
</tr>
<tr>
<td>GROWTH_RATE__LOG__</td>
<td>-0.005204</td>
<td>0.047425</td>
<td>-0.109725</td>
<td>0.9136</td>
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<tr>
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<td>0.044079</td>
<td>-9.423479</td>
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<td>C</td>
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<td>1.366456</td>
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<td>0.0000</td>
</tr>
</tbody>
</table>

R-squared                | 0.978158    | Mean dependent var | 12.67926 |
Adjusted R-squared       | 0.974186    | S.D. dependent var  | 4.243904 |
S.E. of regression       | 0.681851    | Akaike info criterion | 2.237565 |
### Summary Statistics

<table>
<thead>
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<th>Value</th>
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<tr>
<td>Schwarz criterion</td>
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<td>-25.20712</td>
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<td>Hannan-Quinn criter.</td>
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<td>F-statistic</td>
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<tr>
<td>Wald F-statistic</td>
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<tr>
<td>Prob(Wald F-statistic)</td>
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### Residual Analysis

![Residuals Plot](image)

### Breusch-Godfrey Serial Correlation LM Test:

<table>
<thead>
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<td>F-statistic</td>
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<tr>
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<tr>
<td>Obs*R-squared</td>
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<tr>
<td>Prob. Chi-Square(1)</td>
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</table>

### Heteroskedasticity Test: Breusch-Pagan-Godfrey

<table>
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<tr>
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<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>0.633633</td>
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<tr>
<td>Prob. F(7,18)</td>
<td>0.7225</td>
</tr>
<tr>
<td>Obs*R-squared</td>
<td>5.140138</td>
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<tr>
<td>Prob. Chi-Square(7)</td>
<td>0.6429</td>
</tr>
<tr>
<td>Scaled explained SS</td>
<td>3.619536</td>
</tr>
<tr>
<td>Prob. Chi-Square(7)</td>
<td>0.8224</td>
</tr>
</tbody>
</table>
Dependent Variable: PALMA

Method: Least Squares

Date: 12/17/17   Time: 04:41
Sample: 1990 2016
Included observations: 27

<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>CHINAFDI</td>
<td>-4.86E-08</td>
<td>1.96E-08</td>
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<tr>
<td>EDUCATION_COMPLETION</td>
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<td>__LO</td>
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<td>-1.255385</td>
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<td>C</td>
<td>-6.772707</td>
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</tbody>
</table>

R-squared 0.992355  Mean dependent var 6.466451
Adjusted R-squared 0.990534  S.D. dependent var 1.800579
S.E. of regression 0.175181  Akaike info criterion -0.452860
Sum squared resid 0.644458  Schwarz criterion -0.164897
Log-likelihood 12.11362  Hannan-Quinn criter. -0.367234
F-statistic 545.1536  Durbin-Watson stat 1.648493
Prob(F-statistic) 0.000000
Breusch-Godfrey Serial Correlation LM Test:

<table>
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<tr>
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<th>F-statistic</th>
<th>Prob. F(1,20)</th>
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</thead>
<tbody>
<tr>
<td>Obs*R-squared</td>
<td>0.188380</td>
<td>Prob. Chi-Square(1)</td>
<td>0.6643</td>
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</table>

Heteroskedasticity Test: Breusch-Pagan-Godfrey

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<thead>
<tr>
<th></th>
<th>F-statistic</th>
<th>Prob. F(5,21)</th>
<th>0.3388</th>
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</thead>
<tbody>
<tr>
<td>Obs*R-squared</td>
<td>6.038296</td>
<td>Prob. Chi-Square(5)</td>
<td>0.3025</td>
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<tr>
<td>Scaled explained SS</td>
<td>5.296635</td>
<td>Prob. Chi-Square(5)</td>
<td>0.3808</td>
</tr>
</tbody>
</table>

ACKNOWLEDGMENT

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REFERENCES


Im, H. and J. McLaren (2015). Does Foreign Direct Investment Raise Income Inequality in Developing Countries? A New Instrumental Variables Approach*


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Correlation Level of Motorcycle and Travelling Characteristics Using Regression Model

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²Department of Public Administration, Faculty of Administrative Science, Universitas Brawijaya
³Department of Civil Engineering, Faculty of Engineering, Brawijaya University
⁴Department of Civil Engineering, Faculty of Engineering, Makassar Islamic University

Abstract—Inadequate transportation systems create social exclusion problems that encourage ownership of motorcycles for people in the suburbs and inaccessible mass transportation modes. Motorcycles are one of the modes that become the mainstay of low-income family to meet the needs of the movement because it has a relatively affordable price with the ease of the credit system. As a result, there was an inflation of motorcycles among the people in Makassar City, Indonesia, mainly low income people in Banta-Bantaeng and Untia areas. This has become one of the causes of congestion because the number of vehicles is not proportional to the available road capacity. The high frequency of travel and distance from residence to work place and some areas of activity center which become the attraction of society to do the activity of traveling become main cause of society buy and own motorcycle. This study aims to analyze the level of correlation between motorcycle ownership and travel characteristics through linear regression analysis method that is processed with the help of SPSS program 24. The results of this study indicate that there is a relevant correlation between motorcycle ownership and travel characteristics with R Square value of 0.491 means 49.1% for Banta-bantaeng area and R Square value of 0.66 which means that the correlation characteristic of traveling to motorcycle ownership is 66% in the location of Untia region.

Key words- Indonesia, Motorcycle, regression, traveling characteristic

I. INTRODUCTION

Travel behavior is a household decision by many non-spatial factors, such as economic, social, and demographic. It has been investigated by Kitamura which increases household income proportionately to the number of trips for recreational and recreational purposes [1], and to be a means of improving household enterprises, to do what is required on travel at weekend [2]. However, along with the development that is growing far between residential locations with the center of activity due to urban sprawl, arise the opinion that the spatial aspect is a factor more. Vehicle dependence, arising from economic considerations, psychological preference, and habitual behavior, is formulated here as a subjective latent construct that acts in a person’s mode choice [3]. Motorcycles are the main means of transportation in many economically disadvantaged countries. This is mainly because of the affordability of motorcycles [4]. This is also due to high maneuverability in dense streets. Cross-country statistics have revealed the growth of motorcycles in de veloped countries with developing countries due to increased urbanization and personal wealth. In contrast, the country is advancing car growth with increasing revenue. Motor vehicles are a high consequence of population increase. Transportation can be one of the means in achieving the goal of social policy, namely by providing access to participation that can lead to equality. Inadequate transportation systems lead to social exclusion and encourage ownership of motor vehicles for people in the suburbs as well as inaccessible mass transportation modes [5]. As a result, there was an inflation of motor vehicles in motorcycles mainly among the people of Makassar City, including the low income community. Ownership of motorcycles in this study is a force or strength that arises from within the community to provide ease of mobility to achieve the desired goals. In this effort of ownership there is a process undertaken by the community to obtain the motorcycle in accordance with the ability or the carrying capacity of their economy. Operational ownership of motorcycles in this study is a low-income community response to a number of statements about the overall business that arises from within the community to grow the drive to have a motorcycle because the role of a motorcycle so important for the continuity of the family economy so desirable by the community to be achieved. This study aims to analyze the level of correlation between motorcycle ownership and travel characteristics through linear regression analysis method.

II. MATERIAL AND METHOD

This research data is obtained from low income society as research subject and is population in this research. In the description of this data will be described data free variable (Y) that is the ownership of motorcycles and the dependent variable (X) is the characteristics of traveling. The description of the data presented includes the size of the central tendency of mean (M), median (Me), mode (Mo), variance, standard deviation, maximum value, and minimum value. The data collection for motorcycle ownership variable in

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www.ijsrp.org
this research use the research instrument in the form of Likert scale spread to low income society in two residential areas in different sub-districts, Untia and Banta-bantaeng Urban Villages selected as research subjects. While data for travel characteristic variable were taken using questionnaire to see the origin-destination, distance, travel frequency, length of travel. Scores obtained from each question item of each variable were tabulated and calculated using a specific formula as listed in table 2 and table 3. Data obtained through questionnaires were used for testing purposes of hypotheses that have previously been tested for validity and reliability.

A criterion testing instrument validity was calculated value of $r$ exceeds the tabulated $r$ value which means valid question. If otherwise, it means the question was invalid. The tabulated $r$ requirement was 0.3. In this case the grain score was considered X and the total score was considered Y. The correlation number of each item as the result of the calculation is consulted with the table at the significance level of 5% and $N = 96$. Item/question was said to be valid if $r_{xy}$ exceed tabulated $r$. From the table, it was known that tabulated $r$ as 0.3. Thus if the correlation coefficient less than 0.3, it was declared void. Conversely, if the correlation coefficient was equal to or more than 0.3, then the score was valid. Technically, the calculation process was completed with the help of computer with SPSS program 24. The valid motorcycle ownership variable was 13 items, whereas the number of invalid was 3 items. For traveling characteristic, the valid variable was 20 items, while the number of invalid was 5 items. Summary can be seen in Table 1. The next calculation can be seen in the appendix, Summary of validity analysis item questionnaire items and items can be seen in the following table.

From the results obtained in Table 1, it can be seen the questionnaire for motorcycle ownership obtained items 6, 14 and 16 fell because invalid while the questionnaire for the characteristics of traveling obtained grains 6,13,14,15 and 16 fell. Therefore, in the implementation of the research, the item is not used so that the number of items of question items that can be used is 28 statements. The results of this validity calculation did not affect the construction and all aspects of the research instrument. In this case there was no missing or falling aspect. Based on calculations, coefficient of reliability for motorcycle ownership was 0.665 and travel characteristics variable was 0.705. The results were then consulted with the interpretation of the coefficient of reliability used. From the interpretation, it was known that motorcycle ownership and travel characteristics have good reliability so that they are qualified to be used as a measuring and data collection tool of motorcycle ownership and traveling characteristics. The following data reliability test results that can be seen in Table 2.

Table 2. The reliability result summary

<table>
<thead>
<tr>
<th>No</th>
<th>Variables</th>
<th>Result</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motorcycle ownership</td>
<td>0.665</td>
<td>reliable</td>
</tr>
<tr>
<td>2</td>
<td>Traveling characteristics</td>
<td>0.705</td>
<td>reliable</td>
</tr>
</tbody>
</table>

In the process of data collection used measuring instrument in the form of questionnaires as research instruments. For this motorcycle ownership variables the instruments include (a) verbal satisfaction statement, (b) revealing the number of motorcycles, (c) raising the motorcycle, (d) raising the cost, (e) revealing the role of motorcycle for community life, (f) bring up the basis of ownership considerations. These indicators developed into 16 question items as listed in table 3 below.

Table 3. Instrument of Motorcycle ownership

<table>
<thead>
<tr>
<th>No</th>
<th>Indicators</th>
<th>No. of items</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Verbal satisfaction statement</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Revealing the number of motorcycles</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Raising the way to get motorcycle</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Raising the cost</td>
<td>6,7</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Revealing the role of motorcycle for community life</td>
<td>5,8,9,10,11,12,13</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>Bring up the basis of ownership considerations.</td>
<td>4,14,15,16</td>
<td>4</td>
</tr>
</tbody>
</table>

Total 16

Table 4. Indicator of travelling

<table>
<thead>
<tr>
<th>No</th>
<th>Indicators</th>
<th>No. of items</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The tendency to travel using motorcycle transportation mode</td>
<td>3,5,6,9,10,11,12,13,20</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>The travel frequency</td>
<td>1, 2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>The distance and location of travel destination</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Difficulties and ease in doing transportation activities on a motorbike</td>
<td>4, 8</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Availability of public facilities and social facilities</td>
<td>17, 18, 19</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Availability of public transport modes around his residence.</td>
<td>14, 15, 16</td>
<td>3</td>
</tr>
</tbody>
</table>

Total 20

The variable characteristics of the traveling low-income society of the instrument were reflected in the 6 indicators. It included of (a) the tendency to travel using motorcycle transportation mode, (b) the travel frequency, (c) the distance and location of travel destination, (d) difficulties and ease in doing transportation activities on a motorbike, (e) availability of public facilities and social facilities, (f)
availability of public transport modes around his residence. The list of interest learning instruments was as follows:

Each item of motorcycle ownership questionnaire and travel characteristics was measured by ratio scale. For scoring on each item the Likert scale has been modified and prepared for an alternative answer.

For an alternative positive answer:
- SS (Strongly Agree): score 4
- S (Agree): score 3
- TS (Disagree): score 2
- STS (Strongly Disagree): score 1

All data has been collected further in the analysis using linear regression method. Linear regression analysis was an analytical tool used to determine whether there was influence between variables by studying the change in the value of a variable (dependent variable) caused by changing the value of other variables (independent variable) that can affect the variable. The linear regression equation used in the analysis for indicator of travelling as a dependent variable and motorcycle ownership as an independent variable was as follows:

\[
\text{Indicator of travelling} = \beta_0 + \beta_1 \text{Length of travelling} + \beta_2 \text{Public transportation vehicle} + \beta_3 \text{Transportation cost}
\]

To see the level of motorcycle ownership in the research location, the classification of the observed symptoms was observed into 3 (three) categories, namely high, medium, and low. Categories based on ideal standard deviations and ideal mean scores. The classification is as follows.
- High category = if the score is above 35 (thirty five)
- Medium category = if the score is between 21 and 35
- Low category = if the score is below 20 (twenty)

The identification of the trend category or the high degree of motorcycle ownership in this study is based on the above three categories. The mean price obtained for motorcycle ownership variables as listed in Table 8 of the above descriptive data is 48.4 and standard deviation of 3.22. Based on these criteria, obtained the category of motorcycle ownership was listed in Table 8.

### Table 5. The dependent variable

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Code</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator of travelling</td>
<td>XBP</td>
<td>traveling time, traveling frequency, Length of traveling, Public transportation vehicle, Transportation cost</td>
</tr>
</tbody>
</table>

\[
Y_{SP} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \ldots + \beta_{10} X_{10} \quad [1]
\]

\[
\beta_0 = \text{constant}, \quad \beta_1 \ldots \beta_9 = \text{coefficient of each variables}
\]

### Table 6. The independent variable

<table>
<thead>
<tr>
<th>independent variable</th>
<th>code</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>motorcycle ownership</td>
<td>YSP</td>
<td>Number of motorcycle</td>
</tr>
</tbody>
</table>

The result shows that motorcycle ownership in Banta-bantaeng Urban Village was 19 households (19.8%) was in medium category and 77 households (80.2%) were in high category. The following diagram is used to explain the propensity of motorcycle ownership. The motor ownership data (Y variable) was obtained through a questionnaire consisting of 13 (thirteen) statements. Scale value scores for each item is 1-4 with the number of respondents as many as 83 households in Untia Urban Village. Each respondent can get a maximum score of 52 and a minimum score of 13. Based on motorcycle ownership data, the calculation results with the program SPSS version 24 for Windows has a tendency to center with the mean price (M) of 39.88, median (Me) of 47.00, variant of 10.41, range of 12.00, standard deviation of 3.22, minimum value of 33.00, and maximum value of 52.00. The results of statistical analysis of motorcycle ownership are summarized in the following Table 7.

### Table 7. Data Statistical data of motorcycle ownership in Banta-bantaeng Urban Village

<table>
<thead>
<tr>
<th>Motorcycle ownership</th>
<th>N</th>
<th>Valid</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>48.4063</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>47.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>46.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>3.22679</td>
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<td></td>
</tr>
<tr>
<td>Variance</td>
<td>10.412</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>12.00</td>
<td></td>
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</tr>
<tr>
<td>Minimum</td>
<td>42.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>51.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

III. RESULT AND DISCUSSION

1. Ownership of Motorcycles

Motorized ownership data (variable Y) is obtained through a questionnaire consisting of 13 (thirteen) statements. The score scale for each item is 1-4 with 96 respondents in Banta-bantaeng Urban Village. Each respondent can get a maximum score of 52 and a minimum score of 13. Based on motorcycle ownership data, the calculation result with SPSS version 24 for Windows has a tendency to center with the mean price (M) of 39.88, median (Me) of 47.0, variant of 10.41, range of 12.00, standard deviation of 3.22, minimum value of 33.00, and maximum value of 52.00. The results of statistical analysis of motorcycle ownership are summarized in the following Table 7.

Table 7. Data Statistical data of motorcycle ownership in Untia Urban Village

<table>
<thead>
<tr>
<th>Motorcycle ownership</th>
<th>N</th>
<th>Valid</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7618
The identification of the trend category or the high degree of motorcycle ownership in this study was based on the above three categories. The mean price obtained for motorcycle ownership variables as listed in table 9 above descriptive data is 39.88 and standard deviations of 3.23. Based on these criteria, obtained the category of motorcycle ownership as listed in Table 11 below.

Table 11. Distribution of Variable Propensities of Motorcycles Ownership in Untia Urban Village

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency (%)</th>
<th>Cumulative Percentage</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-20</td>
<td>0 (0)</td>
<td>0</td>
<td>low</td>
</tr>
<tr>
<td>21-35</td>
<td>4 (4.8)</td>
<td>4.8</td>
<td>medium</td>
</tr>
<tr>
<td>36-55</td>
<td>79 (95.2)</td>
<td>95.2</td>
<td>high</td>
</tr>
<tr>
<td>Total</td>
<td>83 (100)</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

These results indicate that motorcycle ownership in Untia is 4 households (4.8%) are in the middle category and 79 households (95.2%) are in the high category. The following diagram is used to explain the propensity of motorcycle ownership.

2. Characteristics of Traveling

Travel characteristics data (variable X) were obtained through questionnaires or questionnaires in low-income majority settlement areas in Banta-bantaeng Urban Village. The number of questions asked totals 15 questions has been adapted to the cause of the community traveling from home (origin) to another destination (destination). The score scale is 1-4. Respondents can obtain a minimum score of 15 and a maximum value of 60. Based on the calculation data of community travel characteristics with SPSS 24 for windows program, it is known that the central tendency is obtained by means of mean price (M) of 48.47, median (Me) of 48.00, variant of 5.73, 10.00, standard deviation of 2.99, minimum value 44, and maximum value 54. Summary of statistical analysis results can be seen in Table 11 below.

Table 12. Distribution of Variable Trends in Traveling Characteristics in Banta-bantaeng Urban Village

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency (%)</th>
<th>Cumulative Percentage</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-20</td>
<td>0 (0)</td>
<td>0</td>
<td>low</td>
</tr>
<tr>
<td>21-35</td>
<td>0 (0)</td>
<td>0</td>
<td>medium</td>
</tr>
<tr>
<td>36-55</td>
<td>96 (100)</td>
<td>100.0</td>
<td>high</td>
</tr>
<tr>
<td>Total</td>
<td>96 (100)</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

The results indicate that in Banta-bantaeng Village is 96 families (100%) or all sample of research is in high category. This open diagram is to explain travel attributes. While the data of travel characteristics (variable X) is obtained through questionnaires or questionnaires in the residential areas of the majority of low-income communities in Untia. The number of questions asked totals 15 questions has been adapted to the cause of the community traveling from home (origin) to another destination (destination). The score scale is 1-4. Respondents can obtain a minimum score of 15 and a maximum value of 60. Based on the calculation data of community travel characteristics with SPSS 24 for windows program, it is known that central tendency is obtained by means of mean price (M) of 47.99, median (Me) of 48.00, variant of 8.62, 13.00, standard deviation of 2.94, minimum value 41, and maximum value 54. Summary of statistical analysis results can be seen in Table 13 below.

Table 13. Data Statistical data of traveling characteristics in Untia Urban Village

<table>
<thead>
<tr>
<th>Traveling characteristics</th>
<th>N</th>
<th>Valid</th>
<th>Missing</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>Std. Deviation</th>
<th>Variance</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>83</td>
<td></td>
<td>0</td>
<td>48.4742</td>
<td>48.0000</td>
<td>48.00</td>
<td>2.39397</td>
<td>5.731</td>
<td>10.00</td>
<td>44.00</td>
<td>54.00</td>
</tr>
</tbody>
</table>

To observe the level of traveling characteristics in the study sites, the classification of the symptoms observed into 3 (three) categories are high, medium, and low. Categories based on ideal standard deviations and ideal mean scores.
The classification is as follows.
- High category = if the score is above 40 (forty)
- Medium category = if the score is between 21 to 40
- Low category = if the score is below 20 (twenty)

The identification of the trend categories or the height of low travel characteristics in this study is based on the above three categories. The mean price obtained for the travel characteristics variable as listed in Table 14 above descriptive data is 47.99 and standard deviation of 2.94. Based on these criteria, the category of travel characteristics as listed in Table 14 below.

Table 14. Distribution of Variable Trends in Traveling Characteristics in in Untia Urban Village

<table>
<thead>
<tr>
<th>Interval</th>
<th>Frequency (%)</th>
<th>Cumulative Percentage</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-20</td>
<td>0 (0)</td>
<td>0</td>
<td>low</td>
</tr>
<tr>
<td>21-35</td>
<td>0 (0)</td>
<td>0</td>
<td>medium</td>
</tr>
<tr>
<td>36-55</td>
<td>96 (100)</td>
<td>100.0</td>
<td>high</td>
</tr>
<tr>
<td>Total</td>
<td>96 (100)</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

These results indicate that the characteristics of traveling in Untia Urban Village amounted to 83 families (100%) or the entire sample of the study is in the high category. The following diagram is used to explain the trends of traveling characteristics.

3. Linear Regression Analysis

In general the linear regression equation formula is \( Y = a + bX \). Meanwhile, to know the value of regression coefficient in Banta-bantaeng Urban Village can be based on the output. The regression coefficient in Banta-bantaeng was \( Y = 24.778 + 0.490 \). The value of constant number was 24.778. This number was a constant which means that if there was no traveling characteristics (X) then the consistent value of motorcycle ownership (Y) was 24.778. The value of regression coefficients was 0.490. This number means that every 1% increase in traveling characteristics (X), then motorcycle ownership (Y) will increase by 0.490. Since the value of the regression coefficient is plus (+), then it can be said that the travel characteristics (X) have a positive effect on motorcycle ownership (Y). Based on the above output it is known that the significance value (Sig.) is 0.019 less than probability 0.05, so it can be concluded that there is influence of travel characteristics (X) to motorcycle ownership (Y).

The correlation level between traveling characteristics and motorcycle ownership is high enough so that the main factors of increasing the number of motorcycles in Makassar City was the variety of characteristics traveling from home to downtown and other activity centers. The farther the distance between the house and the purpose of traveling lead the higher the public interest to have a motorcycle. Motorbike use depends on a combination of demographic and economic factors. A study in Taipei, Taiwan showed that motorcycle ownership and usage was due to economical factor. The empirical study in showed the depend on their motorcycles to a chief unaccompanied, short-distance, multistop trips; motorcyclists under the age of 25 who were inferior in economic terms and did not use an automobile showed relatively higher measures of motorcycle dependence [3]. Other study in Barcelona, Spanyol showed that motorbike is seen as a fast and reliable mode of transport in dense urban environments. This motorized two-wheeled mode of transport in everyday mobility is user friendly. Second reason emphasizes the role of the affordability factor to help understand the rise of motorcycle. The specificities of motorbike use pose new challenges to transport policy makers [4].

IV. DISCUSSION

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The corporate governance mechanism and its role in the reduction of financial and administrative corruption

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Abstract-
The emerging phenomenon of administrative and financial corruption is considered as one of the most serious and pressing issues facing a host of countries, including in particular developing countries. In fact, this has led to a recession in the process of economic development and growth, especially with the resulting destruction of the economy and the financial and administrative potential of the state and equally of institutions.

The continuous financial crunches and scandals which affected the largest companies in the world, especially those listed in the capital markets have proved the failure of traditional methods to avert the causes of those mishaps. This in fact prompted the concerned authorities at the national and international levels to conduct in-depth studies to determine the main reasons leading to these financial crises and complications, which were significantly associated with the accounting and financial aspects.

Governance is considered as the most important mechanism in addressing the phenomenon of financial and administrative corruption, and is carried out in the form of a variety of mechanisms, notably transparency and disclosure of financial and non-financial information that are prepared in accordance with accounting standards, as well as strengthening the role of the internal and external auditing, especially with respect to the independence of these two functions.

Key Words- corporate governance; corruption; administrative corruption; financial corruption.

I. Introduction

The problem of corruption has received the attention of many researchers and practitioners interested in this phenomenon, with views, agreeing on the need to develop and establish an institutional framework designed to address the problem thought-out and specific action plans. These plans are aimed at fighting corruption in all its forms and manifestations and in all areas of life to accelerate the process of economic development. The issue of financial and administrative corruption is not confined in terms of its impacts to the negative aspects felt in a certain sector of society, but it also extends to all members and sectors of society.

It certainly has a direct impact on the country’s overall performance in the market and impedes economic development, as well as causing a disruption in the structural foundation of the larger community. In addition, such ill practices can turn individuals against their own values by embracing behaviours that are considered alien and unwelcome in any society where those values and principles are usually well-established. One should not also underestimate its impact on the political life with the disruption to the rules of the game in politics and the emergence of political systems and entities geared towards manipulating capital and using fraudulent means, such as bribery.

It can be noticed that after the various financial crises that occurred in many companies in East Asia, Latin America and Russia in the nineties of the last century, and which were triggered by financial corruption, mismanagement and lack of auditing, experience and skills, in addition to lack of transparency, these crises and failures have led many shareholders to suffer heavy

financial losses, prompting many investors to look for companies that adhere to the concept of corporate governance\textsuperscript{3}. Corporate governance has grown in importance as a result of the tendency of many countries around the world to switch to capitalist economic systems which largely depend on private companies. As a result, there has been increased attention to the concept of corporate governance, which has become one of the key mainstays underpinning economic forms\textsuperscript{4}.

The research aims to highlight the concept of financial and administrative corruption by reviewing its causes and economic, political and social effects, as well as addressing definitional issues of the concept of corporate governance and the principles of the Organization for Economic Cooperation and Development (OECD) and the various advantages and different mechanisms granted by the governance in order to address the phenomenon of financial and administrative corruption\textsuperscript{5}.

A number of studies and research data have indicated that the collapse of many economic firms was caused by the manifestations and effects of financial and administrative corruption, which resulted in the loss of rights for the existing investors and lack of confidence for new investors in these companies. As such, there has been so much interest in the application of the concept of corporate governance as the best solution and the safest and fastest method to address these negative aspects that have surfaced with the collapse of a sizable number of economic institutions. It is appropriate then to put the research problem into context using the following main question: How can the adoption of corporate governance mechanisms address the issue of financial and administrative corruption?

The current research is divided into four main parts, which are as follows:

1. A general overview of corporate governance.
2. Financial and administrative corruption.
3. The role of governance mechanisms in decreasing the financial and administrative corruption.
4. Research findings.

1. General overview of corporate governance

1.1 Theoretical framework for corporate governance:

Even though the term has only been adopted recently- it can be traced back to quite some time. The theoretical and historical premise of corporate governance stems from the Agency Theory, which was introduced by two Americans scholars who noticed that there should be a separation between the ownership of the company’s capital and the process of control and supervision within the managed companies\textsuperscript{6}. This separation has its effects on the company’s performance level. Following Berle and Means, 1932, some other efforts were noted, especially the role of two American economists who won the Nobel Prize for the economy\textsuperscript{7}, who focused on the concept of corporate governance and highlighted its importance in reducing or minimising the problems that might arise from the separation of ownership and management, as shown in the agency theory. In 1976, they offered a definition for this famous theory (Agency Theory) as a relationship under which the main party (capital owner) resorts to the services of another person “worker” in order to substitute or deputise him/her in the performance of some of the tasks. As such, these ‘tasks’ require that he/she acts on the owner’s behalf in power\textsuperscript{8}. This was followed by a host of academic and practical studies which highlighted the importance of adhering to the principles of corporate governance and its impact on increased investor trust in the members of corporate boards; and as such, the ability of states to attract new investors, whether they are local or foreign, and the consequent development of the local economies of these states\textsuperscript{9}. It can be said that corporate governance came as a reaction or...
response to the continuous calls from shareholders to minimise management negative practices and to impose a supervisory system to protect the common interests of all stakeholders and to maintain the lifecycle of the company in the meantime 10.

1.2 Definition of corporate governance:

The term governance is a multifaceted concept with various connotations. First, one should focus on its linguistic and terminological dimensions.

1.2.1 Linguistic dimension:

The word ‘governance’ dates back to an old Greek term (good governor). It refers a ship master’s ability and skills to guide his vessel in the middle of sea waves, hurricanes, and storms. Also, it relates to his noble values and ethics, as well as honesty in preserving the lives and property of ship passengers 11.

The term corporate governance in English comes from the verb ‘governs’, which means rule or dominate; however, in Arabic, there has not been an agreed synonym for the term. Similarly, the collocation of the term with ‘corporate’ has more than one meaning. In this context, meaning, there appears to be more than fifteen meanings in the Arabic language for the term 12. It is also difficult to find a common definition among all economists and legal experts, as well as analysts and accountants for the concept of corporate governance, which can be due to the overlaps in terms of the several regulatory, economic, financial and social issues characterising institutions.

1.2.2 Terminological dimension:

A wide range of definitions has been offered for this term. It is an integrated system of financial and non-financial control, through which an enterprise is managed and controlled. It can also refer to a number of methods that can ensure that investors achieve a reasonable profit for their investments 13. The Organisation for Economic Cooperation and Development (OECD) defined corporate governance as the sum of relationships linking those managing the company’s affairs to the board of directors and shareholders, as well as other shareholders 14. According to the Cadbury Report, 15 “corporate governance is a system whereby companies are managed and monitored.” On the other hand, the Centre International Private Enterprise (CIPE) defines CG as the framework in which institutions exercise its presence, and describes the concept in terms of the relationship among the staff, board members, shareholders, stakeholders and state policy-makers, and how they interact with each other in the process of controlling the company’s operations 16. Given the previous definitions, it can be said that corporate governance is a system intended to develop good applications and practices for those in charge of the company’s management and administration in order to maintain the rights of shareholders, bondholders and employees of the company campaign, as well as other stakeholders. This can be carried out by investigating the application of the contractual relations that bind them using the appropriate financial and accounting tools, according to the required standards of disclosure and transparency.

1.3 The importance and objectives of corporate governance:

As a result of administrative and financial failures occurring in many global companies, interest in the application of the concept of corporate governance has increased by the simple fact that the demise of those institutions was mainly by the lack of a good style of governance.

1.3.1 Importance of the application of corporate governance:

The significance of corporate governance lies in the several advantages it offers, including:

- Fighting against corruption within companies by not allowing it to exist or continue. It is thus a process of completely eliminating corruption and ensuring it has no place inside these companies.

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Ensuring that all employees directly or indirectly involved with the company, including the Board of Directors and executive directors to the lowest ranked in the company integral, impartial, and upright.

Creating a sound and healthy environment free from intentional or unintentional misconduct and preventing the persistence of this behaviour and any other shortcomings.

Dealing with all sorts of misconduct and not allowing any repeat, especially those whose presence constitutes a threat to the shareholders’ interests or whose persistence may make reaching the desired outcomes difficult for the company and thus in need for an urgent reform.

Reducing the margin for error as much as possible through the use of a protective system that prevents these errors and thus avails companies the financial burdens caused by such errors.

1.3.2 Goals of corporate governance:

According to the standards and determinants of corporate governance, the aim is to achieve a number of goals, which can be summed up in the following:

Improving the project’s ability to achieve its objectives by improving the mental image and the positive impression people have about it.

- Enhancing decision-making in companies by increasing managers’ sense of responsibility and the possibility of holding them accountable through the General Assembly.
- Improving the credibility of the data and information and ensuring it is easy to understand across the globe.
- Incorporating considerations of environmental and ethical issues in the decision-making process.
- Improving the degree of transparency, clarity, disclosure and dissemination of data and information to increase the ability of projects to be competitive and attract investment capital and other funds.
- Increasing the administration’s ability to motivate employees, as well maximising the turnover rates of employment and the stability of workers in the workplace.

Corporate governance also allows for the creation of confidence among dealers in the era of financial scandals and recessions and enables business investors to gain access to a wide range of tools that give them control over their assets which are distributed over several investment takings and ensure they maximise their benefits. This is best illustrated in the following figure:

**Figure (1): The objectives of corporate governance**

<table>
<thead>
<tr>
<th>The goals of Corporate governance</th>
<th>Enhancing the mental image about the companies.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Improving decision-making.</td>
</tr>
<tr>
<td></td>
<td>Enhancing corporate credibility.</td>
</tr>
<tr>
<td></td>
<td>Introducing ethical considerations.</td>
</tr>
<tr>
<td></td>
<td>Improving the degree of clarity and transparency.</td>
</tr>
</tbody>
</table>

1.3.2.1 Dimensions of corporate governance and the main implementing parties:

According to the aforementioned, it is evident that there are different dimensions of corporate governance with which many actors continuously interact consistent with their respective powers and responsibilities.

**Corporate governance dimensions:**

Corporate governance has a variety of dimensions that can be summed up in the following elements:

- **The supervisory dimension:** This dimension is related to strengthening and activating the supervisory role of the Board of Directors to assume the tasks of executive management and stakeholders.
- **The regulatory and control dimension:** It undertakes to strengthen and activate the control both of the internal and external level in the company. At the internal level, the support and initiation of control are focused on the activation of internal control and risk management systems, while at the external level, it deals with laws, regulations and rules.

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19 Mohsen Ahmad Al-Khudairi (Corporate governance, the Arab Nile Group), 2005, P21
for registration on the stock market and availing the opportunity for the shareholders and stakeholders to contribute into the monitoring process, as well as expanding the scope of responsibilities of the external auditor and strengthening his/her independence.

- **The ethical dimension:** This is related to creating and improving the auditing environment, including any ethical rules, integrity, trustworthiness, and dissemination of the culture of corporate governance at the executive level and the business environment in general.

- **Communication and maintaining the balance:** This refers to the design and organisation of relations between the company represented by the Board of Directors and executive management on one hand, and external parties, be it those who have interests in the company or the monitoring, supervision and regulatory authorities on the other.

- **The strategic dimension:** It looks into the formulation of business strategies and encouragement of strategic thinking, as well as building a futuristic vision on the basis of a careful consideration and sufficient information on its past and current performance. It is also related to the study of the external environment factors and the assessment of the different impacts on the basis of sufficient information on the internal environment factors and how they influence one another.

- **Accountability:** This component identifies the disclosure of the various activities and performance levels of the company for the purpose of shareholders and others who are entitled legally to hold the company accountable.

- **Disclosure and transparency:** These two dimensions are related not only to the necessary information required to rationalise the decisions of all parties interested in the company, but also expands the concept to include disclosure in the public domain in terms of the general reports indicating adherence to the principles of governance in accordance with the recommendations of the New York Stock Exchange.

**Parties in charge of implementing corporate governance:**

There are four main parties that can affect and be affected by the appropriate application of the rules of governance and may to a large degree determine the extent of success or failure in the application of these rules, including:

- **Shareholders:** This category includes those who provide capital through their ownership of shares and in return for making profits, and also through the maximisation of the enterprise value in the long term. They have the right to choose the members of the Board of Directors who they deem most suitable to protect their interests.

- **Board of Directors:** The Board of Directors formulates the general policies of the organisation and selects the executives who will be entrusted with the day to day management of the activities of the business, as well as supervising their performance. It is also responsible for the structuring of the various committees that play an important role in activating the role of governance in terms of stabilising the business performance, including the Audit Committee and the Risk Management Committee.

- **Management:** Management is responsible for the day-to-day management of the institution and for providing reports on the actual performance to the Board. It is also in charge of maximising profits, in addition to its responsibility towards the disclosure and transparency of the information it publishes.

- **Stakeholders:** Stakeholders are a group of people who have an interest within the organisation, such as creditors, suppliers, workers, and other members of staff, even though these interests can sometimes be conflicting. For example, for creditors, the ability of the company to repay its debt is important, but for the staff, continuity is more important.

**1.3.2.1 Principles of Corporate Governance:**

The principles of corporate governance issued by the Organization for Economic Cooperation and Development (OECD), 2004 are based on national initiatives and experiences of the member states in the organisation and on previous work carried out within the organisation, as well as the contributions of a number of non-member states. One should also mention the contributions of the

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World Bank, the International Monetary Fund, the business sector, and investors, in addition to other interested parties in the issue of corporate governance.

Principles issued by the Organization for Economic Cooperation and Development (OECD):

Ever since these principles were issued in May 1999, they have been the fundamental tenets for the application of corporate governance. There have also been several important amendments that were passed after numerous intensive public consultations and the revised wording of the principles were finally approved by the OECD’s member states on April 22, 2004. The six principles are outlined as follows.

- The introduction of adequate corporate governance frameworks to ensure efficiency, transparency and effectiveness of markets, and to clearly define the allocation of responsibilities among the various supervisory and executive bodies.
- Safeguarding the rights of all shareholders, including:
  - The transfer of stock ownership.
  - The right to choose the Board of Directors.
  - Access to returns of profits and audits of financial statements.
  - The right to participate in the meetings of the General Assembly of the company.
  - The right to vote.
- Equality between all shareholders. In other words, treating shareholders whether internal or external (locals or foreigners) the same in terms of voting in the General Assembly as well as their right to be informed about all relevant transactions.
- Finding a legal mechanism that allows the shareholders participate in the effective supervision of the company and to have access to the required information. These shareholders include bank managers, employees, bondholders and customers.
- The application of disclosure and transparency in a timely manner for all the company’s business activities, including the financial situation, performance, and ownership. The disclosure process should be carried out in a fair way among all shareholders.
- Determining the duties and functions of the Board of Directors and how they are selected, as well as their respective roles in overseeing the company’s management.

Basel Committee Standards on Global Banking Supervision:

In 1999, the Basel Committee issued instructions and guidance on corporate governance in the banking and financial institutions. The following are the most important of these instructions:

- The establishment of ethical agreements among institutions to achieve and implement appropriate codes of conduct between these institutions.
- Developing a strategy for the company that allows for the contribution of all parties and individual participants.

Identifying and assigning responsibilities and decision-making positions among the members of the Board of Directors.

- Identifying a system that includes internal and external auditing tasks and an independent management.
- Providing a framework or a mechanism determining the type and form of cooperation between the Board of Directors and auditors.
- Identifying a form of surveillance for risk areas, such as major shareholders and senior management.
- Ensuring a just and equal process as well as an appropriate criteria when distributing financial and administrative incentives, whether the process involves managers or employees, and whether these incentives include monetary or promotional or administrative benefits.
- Ensuring the provision and flow of the appropriate information.

Standards of the International Finance Corporation:

In 2003, the International Finance Corporation of the World Bank issued a number of financial and administrative rules and principles whose role would be to support governance within companies, including notably:

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• Developing practices that should be good and acceptable.
• Identifying new ways to ensure good governance.
• Key contributions to the development and improvement of good governance at the local level.
• Good leadership\textsuperscript{27}.

Financial and administrative corruption:

There has been increased interest in the issue of corruption since the second half of the eighties due to its negative effects on economic, social and political development. As such, a number of studies tackled the issue of corruption by presenting the various forms of corruption and its manifestations and analysing this phenomenon in a serious endeavour to unveil its causes and thus reduce its proliferation\textsuperscript{28}.

It should be pointed out that the issue of corruption has been a source of concern for many analysts and academics at all the national and global levels. The United Nations Convention against Corruption introduced its preamble with a strong statement indicating the seriousness of this phenomenon and the negative impacts that can have on humanity as a whole. In fact, all states signing up to this convention expressed their concerns about the problems and risks corruption poses to the stability and security of societies all over the world, which can undermine the institution of democracy and its values, as well as other ethical values, such as justice. Other issues resulting from corruption include the fact that it jeopardises sustainable development and puts the authority of law at risk, in addition to its links to other forms of crime, in particular organised crime and financial crime, including money laundering. These states are also concerned about cases of corruption which involve vast amounts of assets, and may at times account for a significant proportion of their resources, which can threaten the political stability and sustainable development in those countries. There is a solid belief that corruption is no longer a domestic affair, but it is a global phenomenon affecting all societies and economies and making international cooperation for its prevention and control a crucial procedure.

1.4 Identifying the notion of corruption:

We will try to define the concept of corruption from a linguistic and terminological point of view.

1.4.1 The linguistic meaning:

Corruption in language dictionaries refers to changing or debasing something by making errors or alterations. It is simply the opposite of rectifying and improving the state of something. The word can even denote nullity and decay, along with many other different meanings that can vary according to its context reference. Among the uses of corruption is famine or drought as in the verse where Allah (SWT) says: “Has appeared the corruption in the land and the sea for what have earned (the) hands (of) people, so that He may let them taste a part (of) that which they have done so that they may return” (Chapter 30, Verse 41). It can also refer to tyranny and arrogance as in Chapter 28 Verse 83- to those who do not desire exaltedness upon the earth or corruption\textsuperscript{26}. It can be inferred from the above how the Quran forbids corruption and makes it one of the most abhorred acts. Thus, it can be said that corruption literally means damage, destruction and disruption, leaving no room for moderation, and is the opposite of reforming and changing for the better\textsuperscript{29}.

1.4.2 The terminological meaning:

A number of definitions have been given to the term corruption, with the most important being that of the Encyclopaedia of Social Sciences, according to which corruption is the misuse of public power to make personal profit. This definition has actually included the bribery of local or state officials, or/and political bribes, with the exception of the private sector. It has also been associated with the breach of the law and public order, and failure to comply with regulations with the purpose to achieve political, economic and social interests for an individual or a particular group\textsuperscript{30}. As for the definition of the IMF, corruption is defined as the overstretched hands that aim to make profits for one person or any other group of individuals. According to the


International Transparency Organisation, the term carries an eloquent and comprehensive meaning as it defines it in terms of the “the abuse of public power for private gain”31.

Therefore, the latter definition provides a number of key elements in that:

- The definition applies to the three governmental sectors; namely, the private, and public.
- It refers to the abuse on the part of the state and the individuals, which ranges between deception and illegal and criminal activities.
- It covers both financial and non-financial gains.
- It refers to the importance of the governance system in terms of controlling and regulating the exercise of power.

It sheds light on the inefficient costs associated with corruption and the transfer of funds to be used where they are not initially intended. With regards to the definition of corruption in the eyes of the Arab legislator, Law 06 issued on 20 February 2006 for all Arab members contained the same terms of the International Convention for the Fight against Corruption known as “Prevention and Combating of Corruption Act”32. In its definition of corruption, Article 2 of this Act in paragraph (a) was restricted all the crimes set forth in Part 4 of the Act. By reference to Part 4 of the Prevention and Control of Corruption Act, it is noted that the Arab legislator has accounted for the criminalisation of a number of acts that amounted to 20 crimes33.

It is clear from all these different definitions that the phenomenon of corruption is based on the transfer of public interests of the group to the private interest, whereby resources and economic return are allocated and distributed according to personal interest and not according to the common good.

1.4.3 The reasons for the emergence of financial and administrative corruption and its dimensions:

There are many different reasons that led to the emergence of financial and administrative corruption and had in the process a number of political, economic, and social implications, which are listed as follows:

1.4.3.1 The reasons for the emergence of financial and administrative corruption:

The negative phenomena affecting communities cannot be addressed unless their root causes are diagnosed. The World Bank has actually identified a variety of reasons for the emergence of financial and administrative corruption, which can be highlighted as follows:

- Marginalisation of the role of regulatory institutions, which may also be suffering from corruption.
- The existence of bureaucratic practices in state institutions.
- There is a state of vacuum in the political scene caused by the struggle for control of state institutions.
- The weakened role of civil society institutions and their marginalisation.
- The befitting social and political environment has largely contributed to the emergence of corruption34.

1.4.3.2 The dimensions of financial and administrative corruption:

In addition to the above, one can identify three dimensions for financial and administrative corruption, which can be summed up as follows:

The political dimension:

The reasons for the administrative and financial corruption can be ascribed to the weak political will in dealing with corruption. In addition, there appears to be no initiatives to combat this plaguing phenomenon. Even when decisions are made for reform, they remain absurd and unfulfilled, which renders the role of reformers meaningless, even though they might have serious and sincere intentions to reform35.

Without the political will, the fight against corruption will be only limited to the theoretical endeavours, while the role of reformers will be confined to appeals and wishes to no avail. The absence of political will lead to the absence of the state’s political, legal and constitutional institutions. As a result, self-motivation to fight corruption will not be as robust as should be under the threat of murder, kidnapping, career marginalisation and elimination, as in the case of Libya now. In addition, the control mechanisms in the state will largely be disrupted, especially that governments do not hold their institutions or administrations accountable even though they already know about their corrupted practices. In addition, the judiciary body treats state officials as untouchable despite the rumours and facts surrounding their financial dealings. As for the control bodies, they are either disabled due to the severity of the corruptive behaviour that exceeds their capacity, or the symptoms of corruption have actually begun to hit their own structures hard.

The economic dimension:
This involves unemployment, low salaries and wages, income inequality, and a significant drop in living standards in general, as well as the absence of economic efficiency in the state and the large number of shady business deals or transactions resulting from the brokerage operations that are largely characterised by financial corruption.

The social dimension:
This is largely manifest when everything acquires a price tag, including a worker carrying out a certain professional duty, or a transaction with the state departments, or the conduct of business affairs. It seems that corruption has become part and parcel of the culture and society in which these practices have been rife to the point that communities have developed their own culture of corruption. In fact, when corruption hits hard at the heart of a society, it is difficult to treat. Similarly, corruption breeds more corruption and corrupt individuals will increasingly look at their activities as common practice, which leads one to assume that it needs a major force to be able to deal with it.

1.4.4 Aspects of financial and administrative corruption and its effects:
Corruption can have very serious and devastating impacts on the economy and society. It can amount to a form of embezzlement of the national wealth, through which public funds can leak illegally into the pockets of corrupt perpetrators, often finding their way out of the country, rather than being utilised locally for the public interest. Corruption also degrades political legitimacy and strips away the rights of ordinary citizens, as well as marginalise them in political life. In addition, it contributes to spin and bias in the economic and political decision-making process, which can result in the wrong choices and decisions being taken and causes services to miss their legitimate target among those desperately in need and be directed towards certain interest groups. When corruption is rampant and in total control in a given society, the political foundations are completely shaken and the rule of law is seriously jeopardised, which gives persistent perpetrators the opportunity to search for other means to gain money illegally. One can safely say that the spread of corruption in all areas of life makes any country suffering from this plague go into a vicious circle that cannot be easily controlled. Financial and administrative corruption have multiple manifestations and serious effects as will be outlined in the following section.

1.4.4.1 Aspects of financial and administrative corruption:
Financial and administrative corruption have a number of economic, social, administrative and moral features, which can be summed in the following:

- The political features: Corruption manifests itself in the prolongation of corrupt authoritarian rule and the loss of democracy, as well as the lack of participation in the political process, not to mention the corruption of the rulers, the government control over the economy and rampant nepotism practices.

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• The financial features: corruption can be manifest in the financial deviations and non-compliance with the rules and financial provisions governing the administrative and financial operations of the country’s institutions, as well as the violation of the financial regulators’ instructions. The major aspects of financial corruption include bribery, embezzlement, tax evasion and nepotism in terms of job appointments and career promotions.  

• The administrative features: From an administrative point of view, this relates to institutional, functional or organisational deviancies revealed in the conduct of public officials while carrying out their tasks of the workplace. Administrative corruption manifests itself in the sluggishness of the staff members and lack of respect for the time factor at work by passing their time engaged in idle activities that have no relevance to their job. In addition, it does refer to lack of responsibility and disclosure of confidential job information.

• The moral features: Ethically, corruption are largely associated with moral and behavioural deviations, as revealed in the conduct of state employees. In this respect, some individuals may exploit their position for personal interests at the expense of the public interest. In addition, there is the practice of favouritism, according to which efficiency and merit considerations are not taken into account when hiring employees.

1.4.4.2 Effects of financial and administrative corruption:

The financial and administrative corruption enables certain individuals, especially in public companies, to acquire monetary gains and other privileges at the expense of others in society. These financial and administrative gains can be seen in the immediate increases that affect the cost of transactions, which is in turn reflected in the price paid by consumers or other beneficiaries for the goods and services provided by the individual(s) paying the bribe.

The increases in the cost may not in any way represent the most serious in comparison to other aspects; however, once it turns into a desire to receive personal gains, it soon becomes the only important element in the business transaction, while setting aside the cost and quality elements, and the date and method of the delivery, as well as all other legal considerations upon the approval of the contract. The only outcome then is the selection of unsuitable suppliers or unfit contractors, in addition to the purchase of faulty or inadequate goods. Accordingly, priority is given to non-essential projects at the expense of the important ones, with no apparent reason except for enabling decision makers and government officials to make quick profit and easy money through bribery and other corrupt means.

In general, one can identify some of the economic effects of corruption, which can be summed in the following points:

• Corruption contributes to the deteriorating state of the public investment and the low quality of public infrastructure, due to the increasing bribery practices that limit or abuse the resources allocated for investment or even fail to make the projects cost-effective.

• Corruption has a direct impact on the size and quality of foreign investment, including the potential transfer of skills and technology resources availed through these investments. A wide array of studies has shown that corruption undermines these investment flows and can even bring them to a halt; and as a result, it contributes to the reduction in tax returns and the decline in human development indicators, particularly with respect to indicators of education and health.

• Corruption is usually associated with deteriorating conditions in terms of income and wealth distribution, with people in power abusing their social and political positions, which allows them to achieve the highest share of the economic benefits provided by the system, in addition to the continuous accumulation of assets. This process allows them to widen the gap between them as the elite and the rest of society.

• Job cuts can be one of the long terms impacts of corruption, as the spread of this phenomenon places obstacles in the face of expanding private enterprise and increases the business costs. As such, this undermines the investment chances of these businesses and forces to go into the non-recognised sector, and ultimately reduces employment opportunities in the private sector as they are more likely going to fail to reach the satisfactory growth levels.


It is worth pointing out that small firms and business are the most affected in such process.

The corporate governance mechanism and its role in the reduction of financial and administrative corruption:

It should be pointed out that financial and administrative corruption is one of the most serious problems faced by private firms and public organisations, in particular. As already mentioned, these types of corruption, which include profits and privileges that are obtained through illegal means, have potential ramifications, with companies bearing the additional costs reflected in the prices of goods produced or services provided. Such practices weaken the companies’ ability to compete and survive and lead to loss of capital. Instead of being drivers of the economy and a leading factor for growth, these companies become an additional burden on the national economy. Corporate governance can thus play an important role in addressing the problems faced by these companies, notably the problem of financial and administrative corruption. This can be done through a range of mechanisms that have been classified by Impavido. Into internal and external governance mechanisms, as briefly addressed below:

1.5 Internal mechanisms of corporate governance

Internal governance mechanisms focus on the activities and practices of the company, as well as taking on the necessary course of action to achieve the company’s goals. Internal corporate governance mechanisms can be classified into the following:

1.5.1 The role of the Board of Directors

As stated by Activists, researchers and practitioners in the field of corporate governance see the Board of Directors as the most appropriate tool to control management behaviour, since this body is responsible for protecting the capital invested in the company from being misused by managers and administrators by means of its legal powers in the appointment, dismissal and reward of senior management.

In addition, an effective board of directors is actively involved in the formulation of the company’s strategy, and provides the appropriate incentives for management, while observing their behaviour and performance, which allows the board to maximise the value of the company.

In order to achieve this, however, the board should be in a strong position to serve the interests of the company. At the same time, the social corporate responsibilities should be taken into account, while assuming the necessary authority to exercise and act upon the internal laws away from any political and bureaucratic interference in the company’s affairs. One should also point out the board’s role in terms of the selection of senior management, as well as the ongoing supervision of the company’s performance and disclosure of its annual and other reports. Figure 2 illustrates the basic components of the Board of Directors (BD).

Figure 2. The basic components of the BD.

<table>
<thead>
<tr>
<th>Components of the BD</th>
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<tbody>
<tr>
<td>Independent supervision</td>
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<tr>
<td>• Independent non-executive members</td>
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<tr>
<td>• Independent leadership</td>
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<tr>
<td>• Non-executive</td>
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<td>• Meetings</td>
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<tr>
<th>Ability to compete</th>
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<tr>
<td>• The ability to replace the BD</td>
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<tr>
<td>• Administrative supervision</td>
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<table>
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<tr>
<th>Setting a strategy</th>
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</thead>
<tbody>
<tr>
<td>• The strategy of each work unit</td>
</tr>
<tr>
<td>• Corporate strategy</td>
</tr>
</tbody>
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43 Ibid

In order to enable the Board of Directors to carry out their guidance and supervision duties, a number of committees have to be created from amongst its non-executive members. The main advantage of these committees is that it does not replace the Board of Directors, but has to submit a detailed report to the board. It can be thus said that the board has the final say and assumes full responsibility.

1.5.2 Audit Committee

Recently, the Audit Committee has attracted great interest by the international scientific bodies, and local and specialist researchers, especially after the financial failures and turmoil befalling international companies. This huge attention is due mainly to the role that could be played by the Audit Committee as one of the corporate governance tools in building trust and increasing transparency in the financial information disclosed by companies, which can be achieved through their role in the preparation of financial reporting and supervision of the internal audit function within companies, as well as supporting the external audit bodies and reinforcing their independence, not to mention the emphasis on adhering to the principles of corporate governance.

The concept of an auditing committee emerged after the financial collapse of some outsized companies, as already mentioned. In the United States, the Sarbanes Oxley Act was issued in 2002 to force all companies to create an Audit Committee because of its important role in the prevention of such financial collapses in the future. This can be seen mainly in the process of preparing financial statements, as well as increasing the internal and external auditors’ autonomy. Therefore, the Act allowed for a new body to oversee and regulate the auditors and facilitated the passage of regulations regarding corporate responsibility.

In the United Kingdom, a number of recommendations were issued regarding the launch of this committee, especially the Smith Report, in which included many guidelines on the role and responsibilities of the Audit Committee and how the disclosure of these responsibilities would be set out in the annual reports of companies.

It should be noted that there are many other countries, such as Canada, France, Germany, Malaysia, and Singapore, where the concept of this committee had existed for such a long time. This concept has evolved after the endorsement of a number of recommendations and proposals to resolve the problems faced by this committee in practice and to enable these committees to become an important tool of corporate governance.

Regarding the creation of audit committees in the state-owned enterprises, it has been shown that the call for such creation appeared for the first time in the recommendations of the King Report in South Africa in 1994 which was followed by many other recommendations to form the committee in many countries. Before addressing the importance of these committees and their duties, one should first look at the purpose behind their creation. Due to the multiplicity of definitions in the literature on audit committees, the researcher will only provide two definitions; the first by one of the professional bodies and the second offered by one of the researchers.

The Auditing Committee is defined by the Canadian Trust for Certified Accountants (CTCA) as “a committee made up of the company’s board members who have focused their attention on the review of the annual financial statements before they are delivered to the Board of Directors”. The committee’s activities can be summed up in the nomination of the external auditor and discussing the scope and results of the investigation with him/her, as well as reviewing the company’s internal control system and ensuring its effectiveness, not to mention the role of the committee in ensuring the application of the corporate governance rules in the auditing process.

According to, an auditing committee refers to “a body created by the Board of Directors, which is made up of a number of non-executive members. The committee meetings should be attended by internal and external auditors, if and when necessary, and roles and/or powers are delegated in accordance with the provisions established by the Board of Directors. In addition, periodic reports have to be submitted to Chairman of the Board.

\[42\] Sullivan, J. D. (2015). “The Moral Compass for Companies.\cite{ibid.}

\[43\] Sarbanes Oxley Act, signed into law on July 30, 2002 by President George W. Bush, is aimed at protecting investors from corporations’ fraudulent accounting practices while mandating strict reforms to financial disclosures and stopping accounting fraud.


\[45\] The King Report (King *I*) (1994) “the most effective summary of the best international practices in corporate governance”.


According to the previous definitions, it is clear that the auditing committee is defined in the light of its members and responsibilities, in addition to being created by the Board of Directors. Its membership is also confined to the non-executive members of the Board of Directors who have both independence and expertise in the field of accounting and auditing. The committee’s tasks and responsibilities relate to financial reporting and review of internal and external audit processes, as well as reviewing the adherence to the rules of corporate governance as set out by the company management\textsuperscript{51}.

1.5.2.1 The functions and tasks of the Audit Committee:

The Audit Committee is responsible for a number of tasks and functions that can be outlined as follows:

- Reviewing the financial statements before submission to the Board of Directors.
- Recommending the appointment, remuneration and exemption of the external auditor.
- Discussing the scope and nature of the priorities in the audits and entering agreements for their application.
- Meeting with the external auditors to address any reservations or problems that may arise during the audit process.
- Holding discussions with external and internal auditors to evaluate the effectiveness of the internal control system in the company and the risk management.
- Overseeing the internal audit function and reviewing their reports and findings, as well as making recommendations to management to take action.
- Carrying out any tasks assigned by the Board of Directors that are relevant to the work of the audit and control committee.

1.5.3 Remuneration Committee

Most of the studies on corporate governance and the recommendations emanating from interested parties have advised that the Board of Directors should create remuneration committees from the non-executive members. In the area of state-owned enterprises, the guidelines of the Organisation for Economic Cooperation and Development (OECD)\textsuperscript{52}, came to emphasise the need for the members of the Board of Directors to create reasonable remuneration so as to ensure the promotion of the interests of the company in the long run by attracting and retaining professionals of the highest calibre.

1.5.3.1 The Remuneration Committee functions and tasks

The functions and tasks of the Remuneration Committee are largely focused on deciding the salaries, allowances and benefits for senior management\textsuperscript{53}. Outlined such responsibilities in the following:

- Deciding perks, bonuses and other benefits for senior management, as well as conducting regular reviews and providing recommendations to the Board of Directors for ratification.
- Developing policies for the senior management bonus programs and reviewing these policies on a regular basis.
- Taking steps to modify the senior management remuneration programs as there might payments that are not reasonably linked to the performance of a member of the senior management.
- Developing policies for the benefits offered by an administration that can be reviewed on a regular basis\textsuperscript{54}.

1.5.4 Appointment Committees

Members of the Board of Directors and staff should be appointed from among the best candidates whose skills and experience should be consistent with the skills and expertise specified by the company. Thus, to ensure transparency in the appointment of the board members and the rest of the staff, a wide range of duties and tasks has been set for the committee.


\textsuperscript{53} Mintz, H. (2015), Manager, Sabby Management, Local Address: Upper Saddle River, New Jersey, United States,

1.5.4.1 The functions and duties of the Appointment Committee

- In collaboration with the Board of Directors and with the approval of the appropriate minister, the appointment committee should take charge of the skills required of a member of the Board of Directors and other sought after members of staff.
- The committee has to establish transparent mechanisms for an appointment to ensure access to the best qualified candidates.
- The committee, along with the rest of the members of the Board of Directors, should constantly evaluate the skills required for the company.
- The committee should announce the required, post and invite qualified candidates to apply for appointment.

It should be pointed out that the commission has to be objective by comparing the qualifications and skills of the candidate with the company’s set of specifications and job description.

1.5.5 Internal Auditing

The internal auditing function plays an important role in corporate governance as it enhances the process by increasing the ability of citizens to hold the company accountable. By carrying certain activities, the internal auditors can increase credibility and ensure justice, as well as improve the staff members’ behaviour and reduce the risk of administrative and financial corruption. In this context, in that all of the internal audit state-owned enterprises and reduce the risk of administrative and financial corruption. In this context, argues that internal and external auditing processes are important mechanisms of control within the framework of the governance structure, in particular with regard to ensuring the accuracy and integrity of financial reporting and the prevention and detection of fraud and forgery. Professional and regulatory bodies have recognised the importance of the internal auditing function in the governance process, including the Cadbury Committee, which has emphasised the importance of the internal auditor in the prevention and detection of fraud and swindle. In order to achieve this, the internal auditing has to be independent, well-organised, and has its own legislation. For this purpose, and as confirmed by the role strengthening the independence of this function can be done when the reports are submitted to the Audit Committee directly and not to the administration. In addition, the effectiveness of the internal audit committee can be increased when its members are able to obtain important and private information about the organisation, as well as strengthening the internal control system and the quality of accounting policies used.

1.6 The external mechanisms of corporate governance:

The external mechanisms of corporate governance are manifested in the variety of controls practiced by the external stakeholders of the company, and the pressures exerted by concerned international organisations. This is one of the major forces placing a tremendous pressure for the application of corporate governance regulations, including the following mechanisms:

1.6.1 The competitive market (products/services) and administrative work market:

The competitive market (products/services) is one of the key mechanisms of corporate governance. Such significance has been emphasised by who stated that if the administration has not carried out its duties properly or eligible, the company will fail to compete with other companies operating in the same industry, and could thus be exposed to bankruptcy.

Therefore, the competitive market of products or services refines the management behaviour, especially if there is an active market for the administrative work of the senior management. This indicates that leading the company to a state of bankruptcy can have a negative effect on the future of the manager and board members. It should be pointed out that the appropriate criteria for selection stipulate that holding positions of responsibility should not be assigned to members of the board of directors or executives that have already led their companies into bankruptcy or liquidation.

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56 CSRC, Administrative Measures for Information Disclosure of Listed Companies (February, 2007).


58 Impavido G. and Hess D. (2003) (as n.30 above)
1.6.2 Mergers and acquisitions:

One of the traditional tools used in restructuring in the corporate sector in many countries all over the world is undoubtedly represented in mergers and acquisitions. Highlighted sections of the literature and other evidence that supports the point of view that acquisition is an important mechanism of corporate governance (in the United States for example).

Without it, one cannot effectively control the behaviour of the administration, as it is often the case that the services of low-performing departments will be dispensed with when the process of acquisition or merger takes place.

In state-owned enterprises, the OECD indicated that the Chinese government, for example, has benefited from this mechanism as soon as they started giving these companies a good deal of autonomy in decision-making, including acquisition and merger decisions. However, the state still needs to rest assured that its rights as a stakeholder are not abused due to such important decisions taken by the departments. In addition, the acquisition has no impact on the state-owned companies because it can happen in private equity companies, which is not the subject of the study. As for mergers, this has been stipulated by the law of public companies; however, as far as the researcher is concerned, this mechanism has not been activated.

1.6.3 External Auditing

The external auditor plays an important role in helping to improve the quality of financial statements. In order to achieve this, he/she should discuss the quality of those statements with the Audit Committee, and not just whether they are acceptable. With the increasing emphasis on the role of boards of directors, and in particular the Audit Committee, in the selection of the external auditor, saw that independent and active committees may call for an audit of a high quality, thus the selection of qualified and specialist auditors in the industry or field in which the company operates.

External auditing is considered the cornerstone of good governance in state-owned enterprises where external auditors can help these companies achieve accountability and integrity, as well as improve their financial operations and provide a climate of confidence among stakeholders and other sharing citizens. The Institute of Internal Auditors (IIA) in the United States of America confirmed that the role of the external audit enhances the responsibilities of corporate governance in terms of supervision, insight and wisdom. Supervision is focused to checking whether the state-owned enterprises are carrying out what they are supposed to do and are being useful in the detection and prevention of financial and administrative corruption. Insight helps decision makers by providing them with an independent assessment of programs, policies, processes and outcomes.

Finally, wisdom is a significant factor as it determines how to deal with the tough tasks and challenges faced by the company. To accomplish each of these roles, external auditors have to adopt financial and performance auditing, monitoring and advisory services. In fact, some professional organisations and regulatory bodies have stressed the need for external auditors to take into account the internal audit function when planning the audit process. Some laws have in fact affected the key actors in the governance process, not in connection with their job and their role.

Legislation and laws

Often, these mechanisms may affect the interactions that take place between the actors directly involved in the governance process. Some laws have in fact affected the key actors in the governance process, not in connection with their job and their role in this process, but on how they interact with each other. For example, with the issuance the Sarbanes-Oxley Act on it became undisputedly the largest federal law, in connection with corporate governance since the issuance of the initial laws in the 1930s on stocks. There have been new requirements since then with regards to public shareholding companies, including increasing the number of independent board members; reinforcing supervision of the Audit Committee over the financial reporting process; requiring the Chief Executive Officer (CEO) and the Chief Finance Officer (CFO) to bear witness on the accuracy of the financial reports and the internal control system; developing effective communication between the external auditor and the Auditing Committee; and determining who in the company can ratify the transactions that have a priority in the company and which may be harmful to the interests of the owners and other corporate stakeholders. Other requirements included the task of appointing and

61 Parker, A (2003), ‘Tories to Lobby against Higgs Plan’, Financial Times, 2 April

exempting the external auditor, as well as approval of non-audit services that can be provided by companies for its customers in the auditing committee.

### 1.6.5 Other external governance mechanisms

In addition to the aforementioned, there are other external governance mechanisms that can complement and positively affect the effectiveness of corporate governance in the process of protecting the interests of stakeholders in the company. 63 Stated that these mechanisms involve— but not restricted to— regulators, financial analysts and some international organisations. For example, the International Transparency Organisation exerts tremendous pressure on governments and states in order to combat financial and administrative corruption.

Similarly, the World Trade Organisation applies countless pressures in order to improve the financial and accounting systems, while in the banking sector, the Basel Committee is pushing hard in order to exercise governance in banking institutions. As such, due to the diversity of governance mechanisms and the multiplicity of their sources, the implementation requires a comprehensive framework that takes into consideration all stakeholders in the companies, whether private or state-owned, as they all play an important role in the governance process through their continuous interaction within the framework of governance. One can refer to the interaction between the auditing committee and the external auditor, the internal auditor, the board of directors and other senior managers, which can have a significant impact in reducing cases of financial and administrative corruption General People’s Congress. 64

### The research findings

Through the examination and assessment of a number of concepts related to financial and administrative corruption and corporate governance, and by reviewing the various governance mechanisms used to deal with this serious issue, a number of results have been achieved, which can be summarised as follows:

- The application of corporate governance is the most effective solution to address the phenomenon of administrative and financial corruption and ensure the rights of stakeholders inside companies and private investors.
- Corporate governance has a major impact and an influential role in protecting the interests of individuals, institutions and communities in many economic, legal and social aspects.
- Good corporate governance helps attract investment, whether foreign or local, reduce capital leakage, and fight corruption.
- Corporate governance helps in the development of fresh and effective systems to assess the performance of public institutions through the principle of accounting costs of material and non-material corruption, so as not to be an excuse to cancel the freeze on anti-corruption for the rise in costs for the of corruption plans.

### Conclusion

In recent times, takes on the issue of financial and administrative corruption has changed and debates are no longer considered a taboo, especially after the issuance of the international convention against corruption. In addition, the private sector has contributed to a great extent in combating financial and administrative corruption and turning into an active participant in the process through the collective efforts to limit its effects.

The principles of corporate governance have become a central theme in the reform process as they seek a decentralised system that not only governs the relationship between owners, investors, creditors and managers, but also serves as an incentive for reform through the application of the best standards of transparency, accountability and legal frameworks, which would curtail financial and administrative corruption and minimise its effects.

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Modelling and Forecasting LKR/USD Monthly Exchange Rates using Constant Elasticity of Variance (CEV) Model

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Abstract- This paper model and forecast monthly exchange rates of US Dollar to Sri Lankan Rupee using Constant Elasticity of Variance (CEV) Model. In this study, five models are formulated considering five elasticity factors $0, 1/2, 1, 3/2$ and $2$. Monthly exchange rates from January, 1995 to December, 2016 were obtained from the official website of Central Bank of Sri Lanka. Among this data, 254 observations were used to estimate the parameters and other 10 observations were used to test the validity of the models. To estimate the parameters, maximum likelihood estimation method is used and the exchange rates are generated using Euler-Maruyama method. The Monte Carlo technique is used for simulation and the accuracy of the forecasts is compared with Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE). The model which has the minimum RMSE and MAPE is chosen as the best model to predict the monthly exchange rate of LKR/USD.

Index Terms- Constant Elasticity of Variance Model, Maximum likelihood estimation, Monte Carlo technique, Euler-Maruyama method, Exchange rate

INTRODUCTION

Most countries use their own currencies as a medium of exchange, similar to the Rupee in Sri Lanka and the Dollar in the United States. Whenever a country with its own unique currency has to make payments to other countries which have different currencies, it has to exchange its currency with other currencies at a given rate of exchange. The rate at which one currency may be exchanged against another is called “the exchange rate”. The exchange rate is formally defined as the number of units of one currency that can be exchanged for a unit of another [3]. Exchange rate is very important in financial market, because it determines the level of imports and exports. Hence modeling and forecasting exchange rate is most important for the people who are doing international businesses to minimize the risk.

There are two pure approaches to forecast foreign exchange rates, fundamental and technical approach. The fundamental approach is based on a wide range of data regarded as fundamental economic variables that determine exchange rates. The technical approach focuses on a smaller subset of the available data. In general, it is based on price information. The analysis is "technical" in the sense that it does not rely on a fundamental analysis of the underlying economic determinants of exchange rates or asset prices, but only on extrapolations of past price trends. Technical analysis looks for the repetition of specific price patterns. Generally, econometric models, time series models or a combination of both methods are used to forecast the exchange rate.

Stochastic differential equation (SDE) models can be used in many fields of science especially in finance. Black-Scholes model is the famous model among them. The constant elasticity of variance (CEV) model is a diffusion model with the instantaneous volatility specified to be a power function of the underlying spot price.

In this research, LKR/USD exchange rate is modeled using the CEV model and forecast the exchange rate using that model. Five elasticity factors $0, 1/2, 1, 3/2$ and $2$ were considered and the best model is selected from these five models. Monthly exchange rates from January, 1995 to December, 2016 were obtained from the official website of Central bank of Sri Lanka. Among these data, 254 observations are used to estimate the parameters and other 10 observations are used to test the validity of the model. Maximum likelihood estimation method is used to estimate the parameters and to approximate the solution of the SDE, Euler-Maruyama method is used. The Monte Carlo technique is used for simulation purpose and the accuracy of the forecasts is compared with Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE).
I. LITERATURE REVIEW

In literature, many studies were carried out to model and forecast the exchange rate. Booth and Glassman (1987), compared the exchange rate forecasting models considering forecast accuracy and profitability. Tenti (1996), proposed the use of recurrent neural networks to forecast foreign exchange rates. Nabni et al. (1996), described how modern machine learning techniques can be used in conjunction with statistical methods to forecast short term movements in exchange rates. Vinod and Samantha (1997), applied eight SDE models to exchange rate dynamics and evaluated the best model. They used three estimation methods, generalized method of moments (GMM), small sigma asymptotic estimating function (SSA-EF) and numerical conditional variance (NCV) method. Soofi and Cao (1999), performed out-of-sample predictions on daily Peseta–Dollar spot exchange rates using a simple nonlinear deterministic technique of local linear predictor. Gencay (1999), investigated the predictability of spot foreign exchange rate returns from past buy-sell signals of the simple technical trading rules by using the nearest neighbors and the feed forward network regressions.

Majhi, Panda and Sahoo (2009), developed two novel ANN models, functional link artificial neural network (FLANN) and cascaded functional link artificial neural network (CFLANN) involving nonlinear inputs and simple ANN structure with one or two neurons. Rime, Sarno and Sojli (2010) examined the linkages between exchange rate movements, order flow and expectations of macroeconomic variables. Jalil and Fleriden (2010) explained the exchange rate movements in the Pakistan foreign exchange market using the market micro structure approach. Simpson and Grossman (2010) used a relative purchasing power parity (PPP) model to construct a time-varying equilibrium exchange rates.

Abdorrahman et al. (2011), developed three decision making models to maximize profit of trades during a specific period and forecasted the direction of exchange rate over a specific period on the basis of values of indicators in previous time period. Pacelli (2012) analyzed and compared different mathematical models such as artificial neural networks, ARCH and GARCH models. Irena and Andrius (2013) discussed the advantages and drawbacks of the main fundamental exchange rate forecasting models. Yuan (2013), presented the polynomial smooth support vector machine (PSSVM) learning model. Minakhi et al. (2014), proposed a hybrid prediction model by combining an adaptive autoregressive moving average (ARMA) architecture and differential evolution (DE) based training of its feed-forward and feed-back parameters. Mehreen et al. (2014), explored Neuro- evolution and evaluated for its application in devising prediction models for foreign currency exchange rates. Tlegenova (2015), modeled yearly exchange rates between USD/KZT, EUR/KZT and SGD/KZT, and compared the actual data with developed forecasts using time series analysis over the period from 2006 to 2014. Urrutia et al. (2015), formulated a mathematical model to forecast exchange rate of the Philippines from the 1st Quarter of 2015 up to the 4th Quarter of 2020 using Autoregressive integrated Moving Average (ARIMA).

II. THE METHODOLOGY

The monthly exchange rate of LKR/USD for the period from January, 1995 to December, 2016 is represented in Figure 1. It can be observed that there is an upward trend of monthly exchange rate of LKR/USD in this period.
The diffusion process of \(X(t)\) at time \(t\) in a CEV model can be expressed as,

\[
dX(t) = \mu X(t)dt + \sigma X(t)^{\beta/2}dW(t) \quad 0 \leq \beta < 2
\]

where \(X(t)\) is the exchange rate at month \(t\), \(\mu\) is the drift coefficient, \(\sigma \) is the diffusion coefficient, \(W(t)\) is a Weiner process and \(\beta\) is the elasticity factor. If \(\beta = 2\), the CEV model returns to the conventional Black–Scholes model in which the variance rate is independent of the stock price. If \(\beta = 0\), it is the Ornstein–Uhlenbeck model.

The solution of the equation (1) can be approximated using Euler-Maruyama method and it is given by,

\[
X(t) = X(t−1) + \mu X(t−1)\Delta t + \sigma X(t−1)^{\beta/2}(W(t)−W(t−1))
\]

In this research, five cases of \(\beta\) were considered. They are \(0, 1, 2, 3, 2\) and \(2\). First of all, the parameters of the equation (1) must be calculated. For this purpose, maximum likelihood estimation method \([1]\) is used.

Let \(x_0, x_1, x_2, \ldots, x_N\) are observed values of \(X(t)\) at the respective uniformly distributed times \(t_i = i\Delta t\) for \(i = 0, 1, \ldots, N\) where, \(\Delta t = T/N\). Let \(p(t_k, x_k|t_{k−1}, x_{k−1}; \theta)\) be the transition probability density of \((t_k, x_k)\) starting from \((t_{k−1}, x_{k−1})\) given the vector \(\theta\).

In maximum likelihood estimation of \(\theta\), the joint density \(D(\theta) = p_0(x_0|\theta) \prod_{k=1}^N p(t_k, x_k|t_{k−1}, x_{k−1}; \theta)\) is maximized over \(\theta \in \mathbb{R}^m\). It is more convenient to minimize the function

\[
L(\theta) = -\ln (D(\theta))
\]

which has the form

\[
L(\theta) = -\ln(p_0(x_0|\theta)) - \sum_{k=1}^N \ln(p(t_k, x_k|t_{k−1}, x_{k−1}; \theta))
\]

One difficulty in finding the optimal value \(\theta^*\) is that the transition densities are not generally known. However, by considering the Euler approximation and letting \(X(t_{k−1}) = x_{k−1}\) at \(t = t_{k−1}\)

\[
X(t_k) \approx x_{k−1} + \mu x_{k−1}\Delta t + \sigma x_{k−1}^{\beta/2}\sqrt{\Delta t} \eta_k
\]

where \(\eta_k \sim N(0, \Delta t)\).

This implies that

\[
p(t_k, x_k|t_{k−1}, x_{k−1}; \theta) = \frac{1}{\sqrt{2\pi\sigma_k^2}} \exp\left(-\frac{(x_k - \mu_k)^2}{2\sigma_k^2}\right)
\]

where \(\mu_k = x_{k−1} + \mu x_{k−1}\Delta t\) and \(\sigma_k = \sigma x_{k−1}^{\beta/2}\sqrt{\Delta t}\).

This transition density can be substituted into the expression for \(L(\theta)\) which can subsequently be minimized over \(\mathbb{R}^m\).

Then, the parameters \(\hat{\mu}\) and \(\hat{\sigma}\) can be calculated using the equations:

\[
\hat{\mu} = \frac{\sum_{k=0}^{N} (x_{k+1}−x_k)}{\Delta t \sum_{k=0}^{N} x_k^{2−\beta}}
\]

and

\[
\hat{\sigma} = \sqrt{\frac{\sum_{k=0}^{N} x_{k+1} \left( x_k^{−\beta/2} - (1 + \mu \Delta t) x_k^{1−\beta/2} \right)^2}{\Delta t}}
\]

for \(0 \leq \beta < 2\).
After estimating parameters, sample paths for the exchange rates can be generated for each value of $\beta$. To simulate these sample paths, Monte Carlo method is used. Monte Carlo means using random numbers as a tool to compute something that is not random. It can be used to solve any problem having a probabilistic interpretation. By the law of large numbers, integrals described by the expected value of some random variable can be approximated by taking the empirical mean of independent samples of the variable.

As an example, let $X$ be a random variable and write its expected value as $A = E(X)$. If we can generate $X_1, X_2, \ldots, X_n$, $n$ independent random variables with the same distribution, then we can make the approximation,

$$\overline{A}_n = \frac{1}{n} \sum_{i=1}^{n} X_i.$$

By law of large numbers, $\overline{A}_n \to A$ as $n \to \infty$. $X_i$ and $\overline{A}_n$ are random and could be different each time we run the program. Still, the target number $A$ is not random.

In this research work, forecasting is an important task. According to the five CEV models which are considered, future exchange rates can be forecasted using Monte Carlo simulation. Finally, the accuracy of forecasting is calculated using two methods, root mean square error (RMSE) and mean absolute percentage error (MAPE). The equations are given by,

$$RMSE = \sqrt{\frac{\sum_{i=1}^{m} (x_i - \hat{x}_i)^2}{m}}$$

and

$$MAPE = \left( \frac{\sum_{i=1}^{m} \left| \frac{x_i - \hat{x}_i}{x_i} \right|}{m} \right) \times 100$$

where $x_i$ is the observed value, $\hat{x}_i$ is the forecasted value at time $t = i$ and $m$ is the number of observations. Minimum value of these values indicate the best model.

III. RESULTS AND FINDINGS

In this research, five CEV models are considered. According to the value of elasticity factor $\beta$, parameter estimations of each CEV model is given in the Table I. To estimate the parameters, 254 observations are used.

<table>
<thead>
<tr>
<th>Elasticity factor ($\beta$)</th>
<th>$\hat{\mu}$</th>
<th>$\hat{\sigma}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.0417</td>
<td>61.7786</td>
</tr>
<tr>
<td>$1/2$</td>
<td>0.0435</td>
<td>19.1334</td>
</tr>
<tr>
<td>1</td>
<td>0.0456</td>
<td>5.9481</td>
</tr>
<tr>
<td>$3/2$</td>
<td>0.0481</td>
<td>1.8568</td>
</tr>
<tr>
<td>2</td>
<td>0.0508</td>
<td>0.5822</td>
</tr>
</tbody>
</table>

By substituting the values of the Table I to the equation (2), Euler-Maruyama approximations of each model can be obtained. Then, by taking the initial value as the exchange rate of January, 1995 more sample paths can be generated. From Figure 2 to Figure 6 represent five sample paths for each CEV model.
Figure 2: Five Sample Paths for the CEV Model \( dX(t) = 0.0417X(t)dt + 61.7786dW(t) \)

Figure 3: Five Sample Paths for the CEV Model \( dX(t) = 0.0435X(t)dt + 19.1334(X(t))^{1/4}dW(t) \)
**Figure 4: Five Sample Paths for the CEV Model**

\[ \frac{dX(t)}{t} = 0.0456X(t)dt + 5.9481\left(X(t)\right)^{1/2}dW(t) \]

**Figure 5: Five Sample Paths for the CEV Model**

\[ \frac{dX(t)}{t} = 0.0481X(t)dt + 1.8568\left(X(t)\right)^{3/4}dW(t) \]
In this study, LKR/USD monthly exchange rates for nine months are forecasted by considering the initial value as 143.9594 Rs/$ which is the exchange rate of March, 2016.

The generated monthly exchange rates of a time point is different to one sample path to another. Hence by generating one sample path, a fixed value for the exchange rate cannot be obtained. Because of that, Monte-Carlo simulation is used to obtain the convergent monthly exchange rate. Figure 7 to Figure 11 illustrate the convergence of exchange rate when the large number of sample paths are generated.
Figure 8: Convergence of Exchange Rate on April, 2016 for the model

\[ dX(t) = 0.0435X(t)dt + 19.1334(\frac{X(t)}{\sqrt{\frac{1}{4}}}dW(t) \]

Figure 9: Convergence of Exchange Rate on April, 2016 for the model

\[ dX(t) = 0.0456X(t)dt + 5.9481(\frac{X(t)}{\sqrt{\frac{1}{2}}}dW(t) \]
Figure 10: Convergence of Exchange Rate on April, 2016 for the model \( dX(t) = 0.0481X(t)dt + 1.8568X(t)^{3/4}dW(t) \)

Figure 11: Convergence of Exchange Rate on April, 2016 for the model \( dX(t) = 0.0508X(t)dt + 0.5822X(t)dW(t) \)
By generating 200000 sample paths and taking the average of each point forecasted exchange rates are obtained. Table II represents the actual exchange rates and forecasted values for each model from April, 2016 to December, 2016.

Table II: Actual and Forecasted LKR/USD Exchange Rates from April, 2016 to December, 2016

<table>
<thead>
<tr>
<th>Month</th>
<th>Actual</th>
<th>$\beta = 0$</th>
<th>$\beta = 1/2$</th>
<th>$\beta = 1$</th>
<th>$\beta = 3/2$</th>
<th>$\beta = 2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/2016</td>
<td>143.9594</td>
<td>143.9594</td>
<td>143.9594</td>
<td>143.9594</td>
<td>143.9594</td>
<td>143.9594</td>
</tr>
<tr>
<td>04/2016</td>
<td>143.9001</td>
<td>144.4051</td>
<td>144.5337</td>
<td>144.5532</td>
<td>144.4990</td>
<td>144.4974</td>
</tr>
<tr>
<td>05/2016</td>
<td>145.6502</td>
<td>144.8608</td>
<td>145.0134</td>
<td>145.0565</td>
<td>145.0581</td>
<td>145.0748</td>
</tr>
<tr>
<td>06/2016</td>
<td>145.2836</td>
<td>145.3562</td>
<td>145.5455</td>
<td>145.5918</td>
<td>145.6683</td>
<td>145.7518</td>
</tr>
<tr>
<td>07/2016</td>
<td>145.4070</td>
<td>145.8443</td>
<td>146.0579</td>
<td>146.1818</td>
<td>146.2689</td>
<td>146.3140</td>
</tr>
<tr>
<td>08/2016</td>
<td>145.6010</td>
<td>146.3502</td>
<td>146.5258</td>
<td>146.7334</td>
<td>146.8723</td>
<td>146.8614</td>
</tr>
<tr>
<td>09/2016</td>
<td>145.7849</td>
<td>146.8095</td>
<td>147.0654</td>
<td>147.2083</td>
<td>147.4450</td>
<td>147.3881</td>
</tr>
<tr>
<td>10/2016</td>
<td>146.8723</td>
<td>147.3390</td>
<td>147.6002</td>
<td>147.7664</td>
<td>148.0006</td>
<td>148.0006</td>
</tr>
<tr>
<td>12/2016</td>
<td>148.8820</td>
<td>148.5570</td>
<td>148.7373</td>
<td>148.8140</td>
<td>149.1268</td>
<td>149.2442</td>
</tr>
</tbody>
</table>

Graphically, The Actual and forecasted exchange rates for each model can be compared as follows:

Figure 12: Actual Rates and Forecasted Rates for the CEV Model $dX(t) = 0.0417X(t)dt + 61.7786dW(t)$
Figure 13: Actual Rates and Forecasted Rates for the CEV Model
\[ dX(t) = 0.0435X(t)dt + 19.1334(X(t))^{1/4}dW(t) \]

Figure 14: Actual Rates and Forecasted Rates for the CEV Model
\[ dX(t) = 0.0456X(t)dt + 5.9481(X(t))^{1/2}dW(t) \]
Figure 15: Actual Rates and Forecasted Rates for the CEV Model $dX(t) = 0.0481X(t)dt + 1.8568(X(t))^{3/4}dW(t)$

Figure 16: Actual Rates and Forecasted Rates for the CEV Model $dX(t) = 0.0508X(t)dt + 0.5822X(t)dW(t)$
Among these five CEV models, the best model can be selected by checking forecasting accuracy measures RMSE and MAPE. Table III represented RMSE and MAPE values for each model.

**Table III: RMSE and MAPE Values for Five CEV Models**

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>RMSE</th>
<th>MAPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.5516</td>
<td>0.3113</td>
</tr>
<tr>
<td>1/2</td>
<td>0.6709</td>
<td>0.3862</td>
</tr>
<tr>
<td>1</td>
<td>0.7631</td>
<td>0.4321</td>
</tr>
<tr>
<td>3/2</td>
<td>0.8970</td>
<td>0.5173</td>
</tr>
<tr>
<td>2</td>
<td>0.8853</td>
<td>0.5210</td>
</tr>
</tbody>
</table>

According to the Table 3, the minimum RMSE and MAPE values can be observed when $\beta = 0$. Therefore it can be concluded that the best CEV model to forecast LKR/USD exchange rate among the five models is the model which has elasticity factor 0. Hence, the best CEV model is,

$$dX(t) = 0.0417X(t)dt + 61.7786dW(t)$$

It can be observed that the model is similar to the Ornstein-Uhlenbeck model.

**IV. CONCLUSION**

According to the results and findings, it can be concluded that the best model to predict LKR/USD monthly exchange rates from April, 2016 to December, 2016 is Ornstein-Uhlenbeck model. The best model may be changed to another model if one consider another data set. Because of that, by updating the exchange rates one can predict any future exchange rate using these models and the best model may be different to Ornstein-Uhlenbeck model.

In this research only five elasticity factors were considered. As a future research work, one can develop this study by considering more than five elasticity factors. Since $\beta$ is continuous, if one can simulate results for more elasticity factors exchange rates can be predicted more accurately.

**REFERENCES**


AUTHORS

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Impact of MGNREGA on Socio Economic Demography: An evidence from FY 2013-14 and FY 2017-18

Bishnu Das

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“We want our own people, people who will fight tooth and nail for our interest and secure privilege for the under-privileged, people who will undo the wrongs done to our people, people who will voice our grievances fearlessly, people who can think, lead and act, people with principles and character. Such people should be sent to the legislatures. We must send such people to Legislatures who will be slaves to none but remain free to their conscience and get our grievances redressed.” - Dr. B.R. Ambedkar [6]

Abstract- Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), 2005, was notified on 7 September 2005. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is the Government of India's largest rural development programmes and is also a radical shift from the earlier programmes in terms of its demand-driven and rights-based architecture. Undoubtedly, the achievements of MGNREGA have been significant since its inception; however, the Act has the huge potential to eradicate poverty, an even greater role in ensuring productive assets and sustainable livelihoods. The mandate of the Act is to provide 100 days of guaranteed wage employment in a financial year (FY) to every rural household whose adult members volunteer to do unskilled manual work. The study is mostly focused on marginalized section of rural India and their performance comparison trend with successive government in power.

MGNREGA has become a fundamental instrument for inclusive growth in rural India through its impact on social protection, livelihood security and democratic governance. Albeit the MGNREGA is a strategic programme in its essence by itself but this paper is the evidence from the FY 2013-14 and FY 2017-18 which is the study of marginalized section of Indian society i.e. Scheduled Castes (SCs) and Scheduled Tribes (STs) and the impact of MGNREGA on weaker section of rural India.

Index Terms- Employment, Poverty, Scheduled Caste, Scheduled Tribes.

I. INTRODUCTION

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), 2005 is a world know scheme of government of India and it is the brainchild of Indian National Congress who adopted this when UPA government led by Dr. Mammotho Singh was in power. The fundamental objective is to provide 100 days job guaranteed to the poor’s for the sustainable livelihood and social security for Scheduled Castes (SCs) and Scheduled Tribes (STs), women, disabled and non-SC/ST. It is evident that, since its inception MGNREGA has achieved remarkable target cited aforesaid and especially for Scheduled Castes (SCs) and Scheduled Tribes (STs) and women of rural India.

MGNREGA in its essence is the strategic programme centrally implemented & centrally funded which not only averts about the 100 days guaranteed jobs but it has also some other significant roles to play with a concrete objectives to achieve them and ensure that rural India is prospering with all dynamism.

The objectives [1] of the programme include:

- Ensuring social protection for the most vulnerable people living in rural India through providing employment opportunities.
- Ensuring livelihood security for the poor through creation of durable assets, improved water security, soil conservation and higher land productivity.
- Strengthening drought-proofing and flood management in rural India.
- Aiding in the empowerment of the marginalized communities, especially women, Scheduled Castes (SCs) and Scheduled Tribes (STs), through the processes of a rights-based legislation.
- Strengthening decentralized, participatory planning through convergence of various anti-poverty and livelihoods initiatives.
- Deepening democracy at the grass-roots by strengthening the Panchayati Raj Institutions (PRIs).
- Effecting greater transparency and accountability in governance.

The study is the evidence from the FY 2013-14 and FY 2017-18 to know about the successive government efforts to empower, provide employment opportunities, social security and a sustainable livelihood to the marginalized section of rural India.

II. OBJECTIVES OF PAPER

1. To study the role of MGNREGA in an economic development in rural India
2. To study the role of MGNREGA & its impact on Scheduled Castes (SCs), Scheduled Tribes (STs), and non-SC/ST states wise.
3. To study the impact of MGNREGA on marginalized section of rural India with comparing the performance for the FY 2013-14 and FY 2017-18.

III. RESEARCH METHODOLOGY

The paper is based on secondary data and collected from website of MGNREGA [7] followed by articles, newspapers, government reports, magazines etc. Graphs and tables have been prepared manually using Microsoft Excel that has been used to analyze the data. Data has been cleaned using a tool Rapidminer specialized for data mining as data has been collected from MGNREGA website.

The Selected Socio-Economic Statistics India, 2011, government of India census has been used for the population density of Scheduled Castes (SCs) and Scheduled Tribes (STs).

The role of MGNREGA in economic development of rural population

As per the government report on “India’s Economic Performance in 2017-18” [6] it is evident that GDP growth of over 7% for the third year in succession in 2016-17, the Indian economy is headed for somewhat slower growth, estimated to be 6.5% in 2017-18, as per first Advance Estimates released by CSO. This is slightly lower than the range of 6.5% to 6.75% being currently projected based on recent developments. With Gross Domestic Product (GDP) growth averaging 7.5% between 2014-15 and 2016-17, India can be rated as among the best performing economies in the world on this parameter.

Albeit with aforesaid Gross Domestic Product (GDP) India is still lagging behind to empower & secure the marginalized section of rural India. The economy of India is the sixth-largest in the world measured by nominal GDP and the third largest by purchasing power parity (PPP). The country is classified as a newly industrialized country, and one of the G-20 major economies, with an average growth rate of approximately 7% over the last two decades but one must have to have a cognizance that despite such a good economic condition why marginalized section is still under depression.

India is still an agriculture based developing country and as per the latest census of 2011, India’s rural population is 68.84% and urban population is estimated to be 31.16%. After the new NDA government led by Narendra Modi came into power in 2014 with a huge margin today we have envisaged with acute pressure on rural India especially on marginalized section of rural India. MGNREGA is the “de facto” scheme especially for rural India to provide 100 days job guaranteed with an average wage distribution as per the MGNREGA Act but it has been not maintained properly wherein the NDA government has cut the financial allocation under MGNREGA. While the UPA government spent Rs 39,778.27 Crore and Rs 38,552.62 Crore on the scheme in 2012-13 and 2013-14, respectively, the spending went down to Rs 36,033.81 Crore and Rs 34,226.80 Crore in 2014-15 and 2015-16 respectively. Funds with states have dried up and 14 states, including Andhra Pradesh, have shown a negative balance.

The tribal population of the country, as per 2011 census [4], is 10.43 Crore, constituting 8.6% of the total population. 89.97% of them live in rural areas and 10.03% in urban areas. The decadal population growth of the tribal’s from Census 2001 to 2011 has been 23.66% against the 17.69% of the entire population. The Scheduled Castes comprise about 16.6 % population in India. So far there is difference between the performance the UPA government & NDA government with respect to MGNREGA and its impact on marginalized section of rural India.

MGNREGA & its impact on marginalized section of rural India

There is a significant evidence of total household reached 100 days limit for the FY 2013-14 and FY 2017-18 while comparing and it has been noted that the number of households reached 100 days limit for the FY 2013-14 and FY 2017-18 is 4444866 and 2209180 respectively as shown in [Fig 1] wherein the number of household reached 100 days limit has been decreased by 2235686 households.

![Fig 1: Total households reached 100 days limit for the FY 2013-14 and FY 2017-18.](http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7621)

Along with that there is a significant trend which can be seen across the Indian states and it is evident that FY 2017-18 performances is negative than the FY 2013-14 on total household reached 100 days limit as shown in [Fig 2]. The impact of MGNREGA on total households reached 100 days limit was better for the FY 2013-14 across the Indian states.

![Fig 2: Trend analysis across the state for the FY 2013-14 and FY 2017-18.](http://www.ijsrp.org)
Fig 3: Total person-days worked (non-SC/ST) FY 2013-14 and FY 2017-18.

Trend analysis across the Indian state shows that there is a marginal increase in total person days worked (non-SC/ST) in the FY 2017-18 than the FY 2013-14 as shown in [Fig 4]. It is a good sign for non-SC/ST population of rural India that the impact of MGNREGA on non-SC/ST is positive, year on year basis, albeit the case is different for SC/ST population of rural India.

Fig 4: Trend analysis across the state for total person-days worked (non-SC/ST) FY 2013-14 and FY 2017-18.

The total person-days worked by Scheduled Castes (SCs) FY 2013-14 and the FY 2017-18 is showing a negative performance wherein total person-days worked by SCs FY 2013-14 and FY 2017-18 stood at 475698481 and 452093511 respectively as shown in [Fig 5]. The difference is 23604970, thereby showing a negative performance for the Scheduled Castes (SCs).

Fig 5: Total person-days worked by SCs FY 2013-14 and the FY 2017-18.

Across the Indian states, the performance shows a negative trend for the Scheduled Castes (SCs) population of rural India which is a growing concern in the FY 2017-18 regarding their social security and livelihood albeit the performance was better in the FY 2013-14 as shown in [Fig 6].

Fig 6: Trend analysis across the Indian states, total person days worked by SCs FY 2013-14 and FY 2017-18.

The total person-days worked by Scheduled Tribes (STs) FY 2013-14 and FY 2017-18 is also showing the negative performance wherein the total person-days worked by Scheduled Tribes (STs) FY 2013-14 and FY 2017-18 stood at 361804282 and 345079129 respectively. The difference between both the financial years is not showing the good year for the Scheduled Tribes (STs) population of rural India as shown in [Fig 7].

Fig 7: Total person days worked by STs for the FY 2013-14 and FY 2017-18.

The trend analysis across the Indian states is not showing a good performance on Scheduled Tribes (STs) for the FY 2017-18 albeit it was better in the FY 2013-14 as shown in [Fig 8].

Fig 8: Trend analysis across the Indian states for total person days worked by STs for the FY 2013-14 and FY 2017-18.

The total Scheduled Castes (SC) households over 100 day limit FY 2013-14 and FY 2017-18 is showing the number of households decreased in the FY 2017-18 and the performance level is not up to the mark wherein total SCs households over 100 days limit FY 2013-14 & FY 2017-18 stood at 950516 and 465865 respectively as shown in [Fig 9]. The difference between both the financial years is 484651, which is the huge margin and the performance is not good in the FY 2017-18.

Fig 9: Total SC households over 100 day limit FY 2013-14 and FY 2017-18.

The trend analysis across the Indian states is showing the bad performance which is the concern in the FY 2017-18 and the livelihood of the SC households are at peril albeit the condition was good in the FY 2013-14 as shown in [Fig 10].
The total Scheduled Tribes (STs) households over 100 days limit for the FY 2013-14 and FY 2017-18 is showing a negative performance specifically against the number of households wherein the total ST households over 100 days limit for the FY 2013-14 & FY 2017-18 stood at 826222 and 454168 respectively as shown in [Fig 11]. The difference between both the financial years is 372054 which is again not the satisfactory performance of MGNREGA.

The study of trend analysis across the Indian states of total ST households over 100 days limit for the FY 2017-18 is very poor in the performance albeit the performance was good in the FY 2013-14 as shown in [Fig 12].

IV. CONCLUSION

The above study is an evidence from successive government which states that the performance of MGNREGA in the FY 2013-14 when the UPA government was in power led by Dr. Manmohan Singh is better than the present NDA government led by Shri Narendra Modi especially for the marginalized section of rural India specifically for Scheduled Castes (SCs) and Scheduled Tribes (STs).

The government of India led by Shri Narendra Modi must empower the MGNREGA in such a manner that it ensures the marginalized section of rural India so that they are not deprived of social security and a sustainable livelihood as that is the sole responsibility of government of India under the MGNREGA Act. Ministry associated to it must allocate funds appropriately and there shouldn’t be any reduction on funds thereby to avoid late payments. The decadal population growth of the tribal’s from Census 2001 to 2011 has been 23.66% against the 17.69% of the entire population can be seen and keeping in mind resources must be appropriately used to ensure that the objectives of MGNREGA are fulfilled across the Indian states.

REFERENCES


AUTHOR

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The Influence of Product Features, Brand Name, Price, and Social Influence towards Purchase Intention of iPhone in Indonesia

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Abstract- The industry of mobile phone always showed drastic and tremendous development in the telecommunication market. New models of smartphone are launched to the market from time to time. Smartphone users increased and sales of various brands of smartphones also increased. iPhone is the second largest market share worldwide. But in contrast to the world market share, in Indonesia iPhone is not included in 5 smartphone brands with the biggest sales in Indonesia. To dominate the gadget market, companies need to know what factors influence purchase intention. This study was conducted on an electronic company that is Apple. This research find out how significant the influence of product feature, brand name, product price, and social influence towards purchase intention of iPhone in Indonesia.

The type of this research is causal with quantitative research methods. Likert scale used to measure each item in the questionnaire as main data collection tool. The analysis technique used is structural equation model (SEM) with partial least square type (PLS). This study used a sample of 115 people with nonprobability sampling method. The study reveals that only Product Features and Social Influence were factors which significantly influence the purchase intention of the iPhone. The influence on purchase intention is 49% and the remaining 51% are influenced by other variables.

Index Terms- iPhone, Product Features, Brand Name, Price, Social Influence, Purchase Intention.

I. INTRODUCTION

The development of advanced technology demands the service providers in the field of technology to competing in making innovations in purpose to attract people to choose their products. Competition in the mobile phone industry is very tight and encourage smartphone manufacturers to continue to competing for market share. The competition is of course based on significant increment in active smartphone users around the world. A survey conducted by TechinAsia [1] shows that the number of active users of smartphones worldwide continues to rise significantly each year. As well as the growing number of smartphone users worldwide, the number of active smartphone users in Indonesia is also increasing.

In the Worldwide smartphone market share samsung is the most widely used smartphone brand in the world up to the first quarter of 2017, while apple is ranked second best-selling smartphone, after which there Huawei, oppo, and Vivo in the next sequence and continued with other brands are combined into one comparison[2]. But in Indonesia Based on a survey conducted by IDC Asia / Pacific Quarterly Mobile Phone Tracker [3] the top 5 best selling smartphone vendors in Indonesia in 2015 are Samsung, ASUS, Smartfren, Advan, and Lenovo. Different with the worldwide smartphone market share, in Indonesia iPhone is not included in the category of top 5 best-selling smartphones in Indonesia. An intention to purchase a product often interpreted as the consumer behavior. This happens when the consumer gets stimulation from external factors which ultimately leads to the emergence to purchase a product based on personal characteristics of each individual in determining a thing[4].

The phenomenon of purchase intention has been growing. According to Rahima et al. (2015), who conducted research on Factors Influencing Purchasing Intention of Smartphone among University Students, the results show that the product features, brand name, and social influence have significantly and positively related to purchase intention[5].

The comparison made by Statista[6] about the price gap between iOS and Android, it shows that price might become one of the factors that may be influencing the purchase intention of iPhone in Indonesia. Compared to devices using the iOS operating system, devices using the Android operating system have a much cheaper price range. Based on the description above the author will conduct research on the Influence of Product Features, Brand Name, Price, and Social Influence towards Customer’s Purchase Intention of iPhone in Indonesia.

II. LITERATURE REVIEW

A. Purchase Intention

Purchase intention is closely related to consumer behavior. This happens when the consumer gets stimulation from external factors which ultimately leads to the emergence of purchases based on personal characteristics of each individual in determining a thing [4]. Purchase intention usually linked to consumers’ behavior, perceptions and attitudes where purchasing behavior is a key point for consumers to access and assess a particular product[7].

B. Product Features

A feature is an attribute of a product that created to comply the satisfaction level of consumers’ needs and wants through possessing of the product, usage, and utilization for a product [8]. Features are a competitive instrument for distinguish the company’s product from competitors’. One of the most
effective ways to compete against the competitors is by being the first producer to introduce a valuable new features to the consumers [4].

C. Brand Name
Brand is a name, term, symbol, sign or design, or a combination of all, that can identifies a product or from a company and distinguishes it from a competitor [9]. Brand names can help consumers identify which products that might benefit them. Brand also shows the quality and consistency of a product, so whenever buyers repurchase the same brand they will get the same features, benefits, and quality every time they buy [8].

D. Price
Price is the amount of money charged for the product or service, or the amount of value exchanged by the customer for the benefit of owning or using the product or service [9]. Purchase intention may be changed under the effect of price or perceived quality and value [3].

E. Social Influence
Social relationships are closely related to consumer decisions to adopt a technology. Social influences come from a variety of people such as neighbors, relatives, family members and friends, as well as from inspirational figures in the media, such as sports celebrities or movie stars [10]. Social influences defined as changes in individual thoughts and feelings, also the attitudes or behaviors in doing something resulting from interactions with other individuals or groups [11].

F. Research Framework

G. Research Hypotheses
H1: Product features significantly influence the customer’s purchase intention of iPhone in Indonesia.
H2: Brand name significantly influence the customer’s purchase intention of iPhone in Indonesia.
H3: Product price significantly influence the customer’s purchase intention of iPhone in Indonesia.
H4: Social influence significantly influence the customer’s purchase intention of iPhone in Indonesia.

III. RESEARCH METHODOLOGY

A. Research Characteristics
This research uses quantitative research approach. The type of research used in this research is causal.

B. Measurement Scale
Scale used in this study is likert scale with the aim to provide information in the form of value on the answer. For each option the answer is scored, the respondent should describe, support the statement (positive) or not support the statement (negative).

C. Research Stage
This research applied several stages of research as shown in figure 2 below:

D. Population and Sample
The population in this study is the user of Indonesian people. Sampling technique used in this research is convenience sampling. Samples taken in this study were 115 respondents.

E. Data Testing Technique
The data testing technique used is the validity and reliability test which is one important aspect that must be considered in arranging the questionnaire. To facilitate the calculation of validity and reliability in order to obtain accurate data and minimize errors, data processing is done with the help of Statistical Programs of Science Software (SPSS) for Windows.

IV. RESEARCH RESULTS AND DISCUSSION

A. Descriptive Analysis Result
1) Product Features
Based on the percentage of the overall score of respondents' answers, obtained an average value of 81.08%. If illustrated in the continuum line it looks as follows:

Based on the figure above, it is known that the percentage of respondents scores on the product features are included in the agree category, is at intervals (68%-84%). Thus, it can be concluded that the product features classified as agree.

2) Brand Name
Based on the percentage of the overall score of respondents' answers, obtained an average value of 84.47%. If illustrated in the continuum line it looks as follows:

Based on the figure above, it is known that the percentage of respondents scores on the brand name features are included in the agree category, is at intervals (68%-84%). Thus, it can be concluded that the product features classified as agree.
Based on the figure above, it is known that the percentage of respondents score on brand name are included in the totally agree category, is at intervals (84% - 100%). Thus, it can be concluded that brand name classified as totally agree.

3) Price
Based on the percentage of the overall score of respondents' answers, obtained an average value of 73%. If illustrated in the continuum line it looks as follows:

![Continuum Line of Price](Fig.5)

Based on the figure above, it is known that the percentage of respondents score on price are included in the agree category, is at intervals (68%-84%). Thus, it can be concluded that price classified as agree.

4) Social Influence
Based on the percentage of the overall score of respondents' answers, obtained an average value of 67.3%. If illustrated in the continuum line it looks as follows:

![Continuum Line of Social Influence](Fig.6)

Based on the figure above, it is known that the percentage of respondents score on social influence are included in the neutral category, is at intervals (52%-68%). Thus, it can be concluded that social influence classified as neutral.

5) Purchase Intention
Based on the percentage of the overall score of respondents' answers, obtained an average value of 74.45%. If illustrated in the continuum line it looks as follows:

![Continuum Line of Purchase Intention](Fig.7)

Based on the figure above, it is known that the percentage of respondents score on purchase intention are included in the agree category, is at intervals (68%-84%). Thus, it can be concluded that purchase intention classified as agree.

B. Analysis of Structural Equation Model

1) Outer Model

The Outer Model is used to determine the validity and reliability of connecting reflective indicators with latent variables tested using three methods of measurement: convergent validity, discriminant validity and composite reliability conducted on all data from 115 respondents.

a) Convergent Validity
Convergent validity test in this research based on the criteria of factor loading value and Average Variance Extracted (AVE), where value for factor loading > 0.5, and AVE > 0.5. The result of loading factor in convergent validity can be seen in Table 1.

<table>
<thead>
<tr>
<th>Latent Variable</th>
<th>Indicator</th>
<th>Loading Factor</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Features (PF)</td>
<td>PF1-PF</td>
<td>0.6563</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>PF2-PF</td>
<td>0.7429</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>PF3-PF</td>
<td>0.6330</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>PF4-PF</td>
<td>0.7451</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>PF5-PF</td>
<td>0.7560</td>
<td>Valid</td>
</tr>
<tr>
<td>Brand Name (BN)</td>
<td>BN1-BN</td>
<td>0.6893</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>BN2-BN</td>
<td>0.7618</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>BN3-BN</td>
<td>0.8313</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>BN4-BN</td>
<td>0.8004</td>
<td>Valid</td>
</tr>
<tr>
<td>Price (P)</td>
<td>P2-P</td>
<td>0.7680</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>P3-P</td>
<td>0.8766</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>P4-P</td>
<td>0.8064</td>
<td>Valid</td>
</tr>
<tr>
<td>Social Influence (SI)</td>
<td>SI1-SI</td>
<td>0.7201</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>SI2-SI</td>
<td>0.7963</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>SI3-SI</td>
<td>0.7287</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>SI4-SI</td>
<td>0.8630</td>
<td>Valid</td>
</tr>
<tr>
<td>Purchase Intention (PI)</td>
<td>PI1-PI</td>
<td>0.7916</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>PI2-PI</td>
<td>0.7565</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>PI3-PI</td>
<td>0.7914</td>
<td>Valid</td>
</tr>
<tr>
<td></td>
<td>PI4-PI</td>
<td>0.8290</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Source: SmartPLS 2.0 Result Processed by the Author

Based on Table 1 the test results show that the value of all items has a loading factor value greater than 0.5. So it can be concluded that all indicators of the variable constructs are valid.

The next test in convergent validity is calculating the AVE value of each latent variable. AVE results on convergent validity can be seen in Table 2.

<table>
<thead>
<tr>
<th>Latent Variable</th>
<th>Loading Factor</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Features (PF)</td>
<td>0.5020</td>
<td>Valid</td>
</tr>
<tr>
<td>Brand Name (BN)</td>
<td>0.5968</td>
<td>Valid</td>
</tr>
<tr>
<td>Price (P)</td>
<td>0.6696</td>
<td>Valid</td>
</tr>
<tr>
<td>Social Influence (SI)</td>
<td>0.6071</td>
<td>Valid</td>
</tr>
<tr>
<td>Purchase Intention (PI)</td>
<td>0.6281</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Source: SmartPLS 2.0 Result Processed by the Author

According to Table 2, the value of AVE in each latent variable is greater than 0.5, which means it can be declared as valid and meets the criteria of convergent validity.

b) Discriminant Validity
Alongside convergent validity, it is also requiring discriminant validity. The criteria on discriminant validity is its latent variable cross loading correlation value should be bigger compare to correlation with another latent variable. The cross loading factor result of each indicators are shown on the table 3 below:

Table 3 Cross Loading Result

<table>
<thead>
<tr>
<th></th>
<th>PF</th>
<th>BN</th>
<th>P</th>
<th>SI</th>
<th>PI</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF1</td>
<td>0.6563</td>
<td>0.4361</td>
<td>0.3102</td>
<td>0.0407</td>
<td>0.4322</td>
<td>Valid</td>
</tr>
<tr>
<td>PF2</td>
<td>0.7429</td>
<td>0.4983</td>
<td>0.5105</td>
<td>0.3792</td>
<td>0.4484</td>
<td>Valid</td>
</tr>
<tr>
<td>PF3</td>
<td>0.6330</td>
<td>0.4880</td>
<td>0.2689</td>
<td>0.2171</td>
<td>0.3574</td>
<td>Valid</td>
</tr>
<tr>
<td>PF4</td>
<td>0.7451</td>
<td>0.5065</td>
<td>0.3713</td>
<td>0.1094</td>
<td>0.3990</td>
<td>Valid</td>
</tr>
<tr>
<td>PF5</td>
<td>0.7560</td>
<td>0.5490</td>
<td>0.4339</td>
<td>0.1384</td>
<td>0.4956</td>
<td>Valid</td>
</tr>
<tr>
<td>BN1</td>
<td>0.4295</td>
<td>0.6893</td>
<td>0.3543</td>
<td>0.2354</td>
<td>0.3418</td>
<td>Valid</td>
</tr>
<tr>
<td>BN2</td>
<td>0.4965</td>
<td>0.7618</td>
<td>0.3630</td>
<td>0.2550</td>
<td>0.3833</td>
<td>Valid</td>
</tr>
<tr>
<td>BN3</td>
<td>0.6700</td>
<td>0.8313</td>
<td>0.4694</td>
<td>0.3661</td>
<td>0.5555</td>
<td>Valid</td>
</tr>
<tr>
<td>BN4</td>
<td>0.5247</td>
<td>0.8004</td>
<td>0.5595</td>
<td>0.4732</td>
<td>0.4698</td>
<td>Valid</td>
</tr>
<tr>
<td>P2</td>
<td>0.4049</td>
<td>0.4230</td>
<td>0.7680</td>
<td>0.1385</td>
<td>0.3311</td>
<td>Valid</td>
</tr>
<tr>
<td>P3</td>
<td>0.5427</td>
<td>0.5078</td>
<td>0.8766</td>
<td>0.3117</td>
<td>0.4718</td>
<td>Valid</td>
</tr>
<tr>
<td>P4</td>
<td>0.3676</td>
<td>0.4725</td>
<td>0.8064</td>
<td>0.3653</td>
<td>0.3938</td>
<td>Valid</td>
</tr>
<tr>
<td>SI1</td>
<td>0.1324</td>
<td>0.2459</td>
<td>0.1820</td>
<td>0.7201</td>
<td>0.2815</td>
<td>Valid</td>
</tr>
<tr>
<td>SI2</td>
<td>0.2568</td>
<td>0.5913</td>
<td>0.4278</td>
<td>0.7963</td>
<td>0.4451</td>
<td>Valid</td>
</tr>
<tr>
<td>SI3</td>
<td>0.2718</td>
<td>0.4221</td>
<td>0.2220</td>
<td>0.7287</td>
<td>0.3564</td>
<td>Valid</td>
</tr>
<tr>
<td>SI4</td>
<td>0.0646</td>
<td>0.2726</td>
<td>0.1554</td>
<td>0.8630</td>
<td>0.2985</td>
<td>Valid</td>
</tr>
<tr>
<td>PI1</td>
<td>0.4120</td>
<td>0.4577</td>
<td>0.4597</td>
<td>0.3758</td>
<td>0.7916</td>
<td>Valid</td>
</tr>
<tr>
<td>PI2</td>
<td>0.4169</td>
<td>0.3179</td>
<td>0.3175</td>
<td>0.2451</td>
<td>0.7565</td>
<td>Valid</td>
</tr>
<tr>
<td>PI3</td>
<td>0.4816</td>
<td>0.4551</td>
<td>0.3435</td>
<td>0.3964</td>
<td>0.7914</td>
<td>Valid</td>
</tr>
<tr>
<td>PI4</td>
<td>0.5873</td>
<td>0.5677</td>
<td>0.4330</td>
<td>0.4091</td>
<td>0.8290</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Source: SmartPLS 2.0 Result Processed by the Author

Table 4 Composite Reliability Result

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach’s Alpha (CA)</th>
<th>Composite Reliability (CR)</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Features</td>
<td>0.7509</td>
<td>0.8337</td>
<td>Valid</td>
</tr>
<tr>
<td>Brand Name</td>
<td>0.7783</td>
<td>0.8549</td>
<td>Valid</td>
</tr>
<tr>
<td>Price</td>
<td>0.7544</td>
<td>0.8584</td>
<td>Valid</td>
</tr>
<tr>
<td>Social Influence</td>
<td>0.7859</td>
<td>0.8601</td>
<td>Valid</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.8044</td>
<td>0.8710</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Source: SmartPLS 2.0 Result Processed by the Author

As shown in the table 5 Product Features has become the most influencing variable towards Purchase Intention, followed by Social Influence. Meanwhile, the Brand Name and Price have the t-value smaller than 1.96. Furthermore, all the variables have a positive path coefficient value.

b) R-square Test (R^2)

In addition to its path value, it is also seen from the percentage of the variance described by the R^2 for the latent variable dependent that is modeled gets the influence of the latent independent variable. The R^2 result of Purchase Intention is shown on table 6 below.

Table 4.5 Path Coefficient and T-Value

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path Diagram</th>
<th>Path Coefficient</th>
<th>T-Value</th>
<th>T-Table</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>PF → PI</td>
<td>0.3919</td>
<td>3.6404</td>
<td>1.96</td>
<td>Ho rejected</td>
</tr>
<tr>
<td>H2</td>
<td>BN → PI</td>
<td>0.1175</td>
<td>0.8951</td>
<td>1.96</td>
<td>Ho accepted</td>
</tr>
<tr>
<td>H3</td>
<td>P → PI</td>
<td>0.1228</td>
<td>1.3264</td>
<td>1.96</td>
<td>Ho accepted</td>
</tr>
<tr>
<td>H4</td>
<td>SI → PI</td>
<td>0.2676</td>
<td>3.1075</td>
<td>1.96</td>
<td>Ho rejected</td>
</tr>
</tbody>
</table>

Source: SmartPLS 2.0 Result Processed by the Author
According to table 6 above the R² result of Purchase Intention is 0.4900 which means that Purchase Intention is 49% influenced by Product Features, Brand Name, Price, and Social Influence. The rest of 51% influenced by other variable outside of the research. Moreover, the result is indicate that the this research model is fallunder “Moderate” classification.

Based on Table 5, the result can be summarized:

1) Product Features
Product features significantly influence the customer’s purchase intention of iPhone in Indonesia. The result in this study is in line with the research that have been done by Rahima et al. (2015)[11].

2) Brand Name
Brand name is not significantly influence the customer’s purchase intention of iPhone in Indonesia. The result in this study is in line with the research that have been done by Kaushal and Kumar (2016)[12].

3) Price
Price is not significantly influence the customer’s purchase intention of iPhone in Indonesia. The result in this study is in line with the research that have been done by Kaushal and Kumar (2016)[12].

4) Social Influence
Social Influence significantly influence the customer’s purchase intention of iPhone in Indonesia. The result in this study is in line with the research that have been done by Kaushal and Kumar (2016)[12].

V. CONCLUSION

Based on the result of data prosesing analisys the researcher can drawing conclusion that can answer the research questions, where the conclusion is as follows:

1) The consumer’s assessment of factors based on proposed model in the context of Product features, brand name, price, and social influence towards the purchase intention of iPhone are: Product Features 81.08% (Agree), Brand Name 84.47% (Totally Agree), Price 73% (Agree), and Social Influence 67.3% (Neutral).

2) The consumer assessment of purchase Intension of iPhone is 74.45% which include in the category Agree.

3) Based on the result variable affecting purchase intention of iPhone in Indonesia are Product Features (3.6404) and Social Influence (3.1075).

4) Based on R-Square result value for Purchase Intention is 0.4900, which means that the variables used in this study affects 49% Purchase Intention and include in moderate category. So, it is can be concluded that this model can be used to predict purchase intention of iPhone in Indonesia.

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Factors Related To Patient Satisfaction at Community Health Centre in Manado City

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Abstract: Public service quality is associated with the service standard in community health center. Communication and performance of health worker is the achievement benchmark of healthcare management. The quality of community health center is people manifestation to gain high-quality service in reaching healthy society in Manado, Indonesia. This research aimed to understand the factors which affect the patient satisfaction in Manado. This research was correlational survey study. Data were obtained from 15 community health centers in Manado which collected from 318 patients. The research variable was community health center leadership and the independent variable was community health center quality. The degree of patient quality was the dependent variable. Data were obtained from direct interview and analyzed by using Pearson correlation test. The result indicated that leadership of the head (r=0.595) and care quality (r=0.513) of community health center had a positive and significant connection with patient satisfaction. The result showed that those were factors related to patient satisfaction in community health center in Manado. Thus, we recommend community health center to improve the leadership and care quality since these factors determine patient satisfaction.

Keywords: Community health center, care quality, patient satisfaction

INTRODUCTION
Community health center (Indonesian: Pusat Kesehatan Masyarakat or Puskesmas) is society foundation which implements individual health service and people health effort in national health system on the first stage. There are a lot of success achieved by community health center in improving the degree of people health nevertheless there are still many problems which could hinder the service in its performance. The quality of community health center is the most important factor to earn customer or patient trust toward health service thus it makes the healthcare staff loyalty increasing in service. According to Witriasih (2012:52) to create customer satisfaction an organization has to provide high-quality service which is the balance between customer hope with the received care.

Classically the patient satisfaction is an attitude based on perceived quality felt by the patient. Costumer satisfaction can influence the interest to come back to the same community health care (Supriyanto, 2010:20). According to Muninjaya (20011:40), community health care should be able to improve quality of care and quality of service because good service quality would give customer satisfaction. Those factors would make the customer come again and recommend the health care to others.

The service system is highly related to care quality. Goetsch and Davis (2008:22) stated that quality of care is a dynamic condition connected to product, service, human, process, and environment that meet or even might be over the hope. Quality of care also defined as something related to the fulfilled hope or demand of society, where care considered as high quality when the product and or service match people demand. This research aimed to understand the relation between the leadership of community health care head and quality of healthcare with patient satisfaction in community health center in Manado.

METHODS
This research used correlational survey method. The research variables were patient satisfaction, leadership, and service quality obtained from 3922 patients of community health centers in Manado city. The locations for pooling data was in Bahu, Minanga, Ranotana Weru, Sario, Teling Atas, Wenang, Ranomuut, Tikala, Paniki Bawah, Bengkol, Kombos, Wawonasa, Tuminting, Bailang, and Tongkaina. The determination of sample measurement referred to Roscoe statement quoted by Sugiyono (2007). The respondents consisted of pregnant women, KB, PUS, and people with the health problem. The univariate and bivariate analysis was done using simple and multiple correlations with significant level 0.01.

RESULT AND DISCUSSION

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The result of this research showed that the score range of patient satisfaction variable was 74-127. The score value indicated mean at 98.07, standard deviation at 10.05, median at 99, and modus at 95. The leadership of community health care got an average value of 116.83 where 129 (39.6%) and 130 (40.9%) respondents belonged to the group of below and above average value respectively. Score distribution of leadership ranged at 91-142.

Score distribution obtained from care quality variable was within range 78-131, average 105.09, standard deviation 9.81, median 105, and modus 98. Care quality score that was below and above average value was 109 respondents (34.3%) and 131 respondents (40.9%) respectively. The detail result of normality test of all variables can be seen in Table 1.

Table 1. Overview of normality test

<table>
<thead>
<tr>
<th>NO</th>
<th>VARIABLE</th>
<th>α·Hit</th>
<th>α</th>
<th>DECISION</th>
<th>INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>X1</td>
<td>0,2</td>
<td>0,05</td>
<td>Accepted H0</td>
<td>Normal</td>
</tr>
<tr>
<td>2.</td>
<td>X2</td>
<td>0,092</td>
<td>0,05</td>
<td>Accepted H0</td>
<td>Normal</td>
</tr>
<tr>
<td>3.</td>
<td>Y</td>
<td>0,2</td>
<td>0,05</td>
<td>Accepted H0</td>
<td>Normal</td>
</tr>
</tbody>
</table>

The analysis of relationships among variables subsequently conducted. The result indicated rejected H0. It showed that variable of head leadership (X1) and quality of care (X2) had positive and significant relation to patient satisfaction (Y). This relation between independent and dependent variable explained as follow:

1. Based on regression analysis and bivariate correlation on leadership variable of community health center head with patient satisfaction, the equation of regression line Ŷ = 35.4 + (0.536)X1 and correlation coefficient 0.595 were attained with significant α= 0.01. Both variables were positively related and very significant, where 35.4% variants occurred on patient satisfaction can be explained by regression equation of head leadership Ŷ = 35.4 + (0.536)X1. It demonstrated that the leadership was one of the predictors of patient satisfaction. Both variables were positively related and very significant, where 28% variants occurred on patient satisfaction can be explained by regression equation of head leadership Ŷ = 35.4 + (0.536)X1. It showed that effective and dynamic leadership was dominant factor to determine the degree of patient satisfaction. Bureaucratic leadership style which was assessed by community health center worker and the patient was also pleasant, supporting, and able to improve patient satisfaction which in return it impacted to the improving service of quality.

Leadership is a way of a leader affecting the subordinate act in order to joint and work productively to achieve the purpose of the organization (Trihono 2005:52). It is an approach which is more sensitive, flexible, and comprehensive to understand phenomena in society. Waridin and Guritno (2005: 25) stated that a leader must implement leadership style to manage the subordinates because a leader would greatly affect the success of the organization reaching the aim. Therefore, an organization needs a reformist leader which is able to become transformation motor to the more positive direction including in improving staff disciplinary.

Leadership is an important element in leading others. A leader has to learn knowing situation and managing information, instead of only giving work direction to other people. The thing needs to be prioritized by the head of community health center is how to use his or her personality effectively in running the health center. Thus the potential negative effect which might be a problem for others can be restrained. Leadership is an ability of a leader to inspire and guide individual or group. Since the role of head of community health center is to develop a culture of quality, therefore the head has a vision about integrated quality for the institution. Moreover, the head has apparent commitment concerning quality development process as well as convinces the medical need of society.

The leadership principle of community health center head referred to the rule of Indonesian health ministry no.128/Menkes/SK/II/2004 stating that community health center is technical implementor unit of district/city health authority that is responsible as the leader that conducts health development in a certain working area. Community health center only has a responsibility as part of health development efforts given by district/city health authority according to its capacity. Health development is the implementation of health effort by community health center head to increase awareness, willingness, and the ability of healthy life for every person in order to create optimal society health degree. Therefore the head of community health center must pose appropriate background and knowledge of health. It means that head of community health center (1) understands the foundation of community health care: philosophy, health science, and scientific, (2) understands and appreciates the nature of human, society, and community health center in implementing health establishment, (3) understands, appreciates, and conducts the task and function in the organization, (6) understands policy, planning, program, province, district/city, and subdistrict.

2. Based on regression analysis and bivariate correlation on service quality and patient satisfaction, it indicated that service quality was one of the predictors of patient satisfaction. It was demonstrated by linear regression equation Ŷ= 42.864 + (0.525)X3 and
correlation coefficient 0.513 with both significant level $\alpha = 0.05$. Both variables were related positively and very significant, where 26.3% variants occurred on patient satisfaction could be explained by service quality of that regression line.

The use of community health center has influencing factors including customer (education, profession, knowledge, other patient perception), organization (resources, accessibility of service, social access), care provider (worker attitude) Dever (2009:84). To anticipate those factors, Muninjaya A.A.Gde, (2011:105) stated that it is better for community health center to improve quality of care and quality of service because high-quality service would give satisfaction to the customer. In addition, the customer would reuse and recommend the community health center to other people. Several problems in the service were the limited medical staff and medical knowledge. The general practitioner assigned by the government was available in community health center only for several hours in a day. Apart from medical staff, the healthcare facilities were minimum, majority old and not maintained properly. According to Aulia (2014), the cause of the problem was the work of the medical and nonmedical staff which was not professional such as coming late, going home early, not keeping the appointment time, etc.

The result indicated that there was a positive relationship between quality of care and patient satisfaction. Based on our finding, we suggest that improvement of care quality is needed to give the better satisfaction of patient through some implication including:

a. Community health center is an institution providing healthcare service. It is expected that quality service provided by the head and staff should be improved constantly so that community health center become famous due to its service quality. Health care quality is the expectation of many people. The head of community health center has a strong role in coordinating and moving nurses and general practitioner in his or her environment. The head is the main factor that can propel components to make service quality which has an orientation of people satisfaction. Therefore the head is demanded to have management and other strong capabilities to be able to make decision and initiative to improve service quality. It means the head of community health center that is strong has the capability to mobilize the resources that mainly customers to reach the expected healthcare service.

b. The effective community health center is always responsive to use various aspects of the environment in form of human resources to provide achievement clarity of optimum service quality. Therefore the partnership of community health center and society need to continually tie together to participate in evaluating the expected service quality. Thus to make something valuable is based on how service institute manager to the customer demand. Service is abstract output, containing direct connection with the customer.

c. The effective community health center is the one that shows the high standard of healthcare achievement and reaches a health care purpose orientated-culture. Therefore in the effort of finding the best way achieving the aim of health care which has better quality, relevant, effective, and efficient, it is a must to have the professional quality of care defined as able to conduct the given task.

CONCLUSION
This research concluded that leadership of the head of community health center and care quality had positive and significant relation to patient satisfaction. Based on the result, several suggestions can be put forward regarding patient satisfaction for the improvement of community health center leadership and care quality as follow:

1. The head has to master certain skill and competency to support the implementation of the task in leading community health center. Competency of community health center head as written in Indonesian health ministry rule no 971 the year 2009 about competency standard of Indonesian health structural officer consisted of personal, managerial, supervision, and social dimension.

2. The relationship between community health center and people was done to connect the necessity of community health center and people themselves. Community health center communicates with people to understand the medical requirement for people. It is necessary to build a connection between community health center and people to maintain and develop effective bidirectional information as well as supporting each other to create a healthy society.

REFERENCES


Determinants of P/E Ratio: An Empirical Study on Listed Manufacturing Companies in DSE

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Abstract: Price-to-Earnings ratio, one of the most widely used tools for stock selection, a relative valuation technique which always remained as a center concern of investors and market analysts. Variations of P/E ratio have significant impact on investor’s perception and several factors are responsible for the variations of P/E ratio. This paper is an attempt to identify the major determinants for P/E ratio of manufacturing companies listed in Dhaka stock exchange. Descriptive statistics, correlation matrix and regression analysis are used to accomplish the objectives of this paper. Results reveal that dividend yield, leverage, size and net asset value per share are significant determinants of P/E ratio where dividend yield and size have negative influence but leverage and net asset value per share have positive influence on P/E ratio. This paper is an evidence for fundamental analysts or decision makers to evaluate determinants that explain variations in Price-to-Earnings ratio of manufacturing firms of Bangladesh.

Keywords: Bangladesh, DSE, Manufacturing firms, P/E ratio etc.

1. INTRODUCTION:
Organization’s long run survival or potentiality largely depends on its competitive advantages. Possibility of creating these competitive advantages largely depends on its competitiveness in stock market. Publicly listed companies always try to capture relative attractiveness in the stock market and wealth maximization goal always directs the firm to do so. But from the opposite side the investors try to judge the absolute position and the relative attractiveness of the firm. In this context the researchers, market analysts, fund managers and investors rely on various valuation techniques. However most of them rely on Price-to-Earnings ratio for valuing and evaluating individual stocks (Molodovsky 1953), where P/E ratio is a useful metric for evaluating the relative attractiveness of a company's stock price compared to the current earnings of a firm. P/E ratio, measured as dividing stock price by earnings per share, alternatively known as “Price Earnings Multiples”. Considerable research has focused on Price-to-Earnings (P/E) ratio in analyzing the stock market performance through time series analysis. Sometimes these comparisons of P/E ratio may be misleading due to lack of relevancy of this ratio in firm performance unless changes in the underlying fundamental determinants of P/E are taken into account. Previously researchers tried to identify the determinants of P/E ratio that can influence investor’s confidence towards firms for making investment decisions. Existing literature has studied the determinants of Price-to-Earnings (P/E) ratio by using various proxies of growth, dividend payout, risk and discount rate generally in developed countries (Dudney et el., 2008; Shamsuddin and Hiller, 2004 and White, 2000). However, some studies have analyzed the factors influencing price earnings ratio in developing countries (Kumar and Warne 2009; and Ramcharran 2002). Additionally to firm-specific factors, fewer studies have examined sector, size and year effects (Kumar and Warne, 2009; and Anderson and Brooks, 2006). The result was mixed and not conclusive in nature. Here this paper is also an attempt to identify some conclusive remark about the major determinants of P/E ratio.

2. LITERATURE REVIEW:
Price-to-earnings ratio has gained enormous concern for evaluating individual stocks among the investors and other related parties. Numerous studies have been performed regarding the P/E ratio. Empirical results from these studies are mixed and sometimes controversial. This study is an attempt to reveal the determinants of P/E ratio, which was performed previously by different researcher but quite in different context. Dr. O. B. Emudainohwo (2017) examined that dividend growth rate has negative impacts on P/E ratio but results are not sufficient to explain movements in P/E ratio for non-financial firms listed in the NSE over the period examined. Although, the results are not sufficient to explain movement in P/E ratio, it however tends to suggest that dividend growth rate is inversely related to P/E ratio, but not moving in the same direction as theoretically expressed.
E. Nikbakhi & C. Polat (1998) stated that increase in DPS over time while maintaining a long-term growth rate is expected to relate with higher P/E ratio. Perhaps, due to promising information contents from firms, the relatively more dividend paying firms should be related with relatively higher P/E multiples.

T. Afza and S. Tahir (2012) found that dividend payout ratio is the most important determinants of price earnings ratio. Y. R. Bhattarai (2014) and Dr. M. Azam (2010) found that dividend payout ratio has the significant positive association with P/E ratio but M. Taliento (2013) identify that dividend payout ratio has insignificant relationship with price earnings ratio. In the study of Dr. M. A. Almumani (2014), it is found that dividend payout ratio is negatively correlated with price earnings ratio. In the study of H. Wenjing (2017), it is found that dividend payout ratio does not affect on the price earnings ratio. B. Jitmaneeroj (2017) concludes that the relationship between dividend payout ratio and price earnings ratio is insignificant.

M. Taliento (2013), Y. R. Bhattarai (2014) and B. Jitmaneeroj (2017) considered dividend yield in their study to correlate with price earnings ratio. (Marco Taliento, 2013) found the negative association between dividend yield and P/E ratio. In the study of Y. R. Bhattarai (2014), it was found that dividend yield showed the significant inverse association with share price and also found that dividend yield is the most influencing factors in determining share price in Nepalese commercial banks. B. Jitmaneeroj (2017) considers dividend yield in his study and that is positively correlated with price earnings ratio.

The earnings growth showed insignificant relationship with price earnings ratio (Dr. T. Afza and Ms. S. Tahir, 2012). In the study of Dr. M. Azam (2010), it was found that earnings growth has significant positive effect on price earnings ratio. Richard et al. (2014) examine the earnings growth in their study that is the significantly related to changes in price earnings ratio. K. C. Parker (2005) found there to be a positive relationship between the payout ratio and earnings growth across the United States, Canada and Australia, with the relationship weakest in Australia over the period 1956 to 2005. In this report earnings growth shows insignificant relationship with price earnings ratio at 5% level of significance.

Dr. T. Afza and Ms. S. Tahir (2012) found that leverage is negatively correlated with price earnings ratio. The estimated results a negative effect of leverage on P/E ratio, supporting of H. Ramcharran (2002), C. P. Jones (2000), and W. Beaver and D. Morse (1978). H. Arslan, Y. Iltas and T. kayhan (2017) argued that P/E decreases as the leverage of company increases. The uptrend in leverage bodes the bankruptcy risk of the firms. This has a negative effect on market multiples. The increase in the working capital need is also a sign of risk levels of the companies and it decreases PE ratios, all other factors are fixed, in the average. In other words, even if the company has a strong net profit, it may lose its net profit due to investment in working capital and cannot generate cash in the bottom line. Investors seem to take this into account working capital effect in the target PE formation.

M. Taliento (2013) and H. Wenjing (2017) in their study they used return on equity (ROE) to correlate price earnings ratio. H. Wenjing (2017) illustrates that (ROE) is the direct determinant of P/E ratios conclude that ROE is negatively related with P/E ratio. S. H. Penman (1996) gave a detailed discussion about the theoretical essence of P/E ratio and return on equity (ROE). The study concludes that P/E ratio is a united decision of current and future ROE; it has negative relation between current ROE. J. Ohlson and Z. Gao (2006) theoretically predict a U-shaped relation between the forward P/E ratio and return of equity (ROE). They propose that firms with very high or very low ROE have higher forward P/E ratio than other firms.

Dr. Talat Afza and Ms. Samya Tahir (2012), Yuga Raj Bhattarai (2014), Gurdep Baksi and Amy Chan (2000), Keith Anderson and Chris Brooks (2006), Anthony Flint, Andrew Tan and Gary Tian (2010), Dr. Mohammad Abdelkarim Almumani (2014) used firm’s size as their independent variable to correlate with price earnings ratio. Dr. Talat Afza and Ms. Samya Tahir (2012) found a negative relationship of size with P/E ratio for the first three years of study i.e. 2005, 2006 and 2007, whereas sign turned to positive for the next two years i.e. 2008 and 2009. This implies that during the stock market growth, investors value more the shares of small firms as they have growth opportunities but as the stock market start declining investors pull out their investments from small firms and prefer to invest in the shares of large and stable firms. In Yuga Raj Bhattarai (2014), it was found that size is significantly positively related with price earnings ratio which means that these variable move together with share prices. Anthony Flint, Andrew Tan and Gary Tian (2010) found in his research paper that the size variable indicates that larger firms have slower earnings growth than smaller firms.

Dr. T. Afza and Ms. S. Tahir (2012) found that Tobin’s Q remains the most important determinants of price earnings ratio for pooled as well as time series analysis.

3. RESEARCH PROBLEM AND QUESTIONS:

In capital market P/E ratio is one of the most dominant factors. Furthermore, many studies have conducted to make a concluding remark about the determinants of P/E ratio. But in real world, this issue is a complex term because the uniqueness of each market and each industry can alter noticeably the ultimate conclusion. Till now, it’s an unresolved issue and this is highly true for the country like Bangladesh where the capital market is not enough matured in terms of quality and time. So this article is an attempt to identify the validity of some most common factors as the determinants of P/E ratio.

In this context, the research question of this article is as follow:
Whether the dividend growth, dividend payout ratio, dividend yield, earnings growth, leverage, net asset value per share, return on asset, return on equity, size, and tobin’ Q have any relationship with P/E ratio?

Whether the relationships of dividend growth, dividend payout ratio, dividend yield, earnings growth, leverage, net asset value per share, return on asset, return on equity, size, and tobin’ Q with P/E ratio are positive or negative and in what extent?

4. RESEARCH METHODOLOGY:
   a. Sampling and data collection:
   This article is an outcome of all the listed manufacturing firms in Dhaka Stock Exchange (DSE). The sample of the study consists of 45 companies. So at first instance there were 225 samples but unavailability some companies are excluded from the final sample. The period for this study is selected from 2011 to 2015. All the data are secondary in nature and are collected from the financial statement of the selected companies.

   b. Variable description:
   This article is an attempt to identify the determinant of P/E ratio. So price/earnings ratio is the dependent variable for this study. In this respect, a large number of factors are available as independent variables. We have selected ten factors as dependent variable i.e. dividend growth, dividend payout ratio, dividend yield, earnings growth, leverage, net asset value per share, return on asset, return on equity, size and tobin’ Q.

   Dependent Variable:
   Price-earnings ratio (P/E ratio): The price-earnings ratio (P/E ratio) measures its current share price relative to its per-share earnings. The price-earnings ratio is also sometimes known as the price multiple or the earnings multiple.
   
   \[
   \text{Price-earnings ratio (P/E ratio)} = \frac{\text{Market Value Per Share}}{\text{Earnings Per Share}}
   \]

   Independent variables:
   Dividend growth (DG): Dividend growth rate is the annual percentage rate of growth that a dividend achieves over one year.
   
   \[
   \text{Dividend growth} = \frac{D_1 - D_0}{D_0}
   \]

   Dividend payout ratio (DPR): Dividend payout ratio indicates the portion of net income that is distributed to shareholders in the form of dividends during the year. The formula is below:
   
   \[
   \text{Dividend payout ratio} = \frac{\text{Dividend}}{\text{Net Income}}
   \]

   Dividend Yield (DY): Dividend yield indicates how much a company pays out as dividends each year relative to its share price. Dividend yield is calculated as follow:
   
   \[
   \text{Dividend Yield} = \frac{\text{Dividend}}{\text{Share Price}}
   \]

   Earnings Growth (EG): This ratio measures the growth of company's net income over a specific period, often one year. The formula is as follow:
   
   \[
   \text{Earnings growth} = \frac{N_1 - N_0}{N_0}
   \]

   Leverage ratio (Lev.): Leverage ratio indicates that how much asset comes in the form of debt (loans) and assesses the ability of a company to meet financial obligations.
   
   \[
   \text{Leverage} = \frac{\text{Total Debt}}{\text{Total Assets}}
   \]

   Net Asset Value per Share (NAVPS): Net asset value per share indicates the value of a share which is calculated by subtracting total liabilities from total assets and dividing the result by the number of shares that exist. The formula is as follow:
   
   \[
   \text{Net Asset Value per Share} = \frac{\text{Total Assets} - \text{Total Liabilities}}{\text{Number of Outstanding Share}}
   \]

   Return on assets (ROA): Return on assets measures the company’s profitability in respect to its total assets. The formula is as follow:
   
   \[
   \text{Return on Assets (ROA)} = \frac{\text{Net Income}}{\text{Total assets}}
   \]

   Return on Equity (ROE): Return on equity is the amount of net income returned as a percentage of shareholders equity. The formula is as follow:
   
   \[
   \text{Return on Equity (ROE)} = \frac{\text{Net Income}}{\text{Total shareholder equity}}
   \]

   Size (SZ): Firm size can be stated in total of assets or total sales. Here size is measured as natural log of sales.
   
   \[
   \text{Size} = \log (\text{total sales})
   \]

   Tobin’s Q (TQ): The Tobin's Q ratio is initiated by James Tobin of Yale University, Nobel laureate in economics, who argued that the combined market value of all the companies on the stock market should be about equal to their replacement costs. This
ratio is calculated as the total market value of a company i.e. market value of all outstanding share divided by the replacement value of the firm’s assets.

\[
\text{Tobin’s Q} = \frac{\text{Total Market Value of Firm}}{\text{Total Asset}}
\]

c. Procedure of data analysis:
In this study, different statistical tools have been applied. A supporting tool named descriptive statistics has been performed to postulate statistical characterization of the variables. Correlation matrix executes the inter relationship among the variables whereas regression analysis is used to evaluate the determinative relationships of independent variables with the dependent variable.

d. Generation of Hypothesis:
According to the objectives, and taking into account the previous research, the research hypotheses that this study investigates are:

\[H_{01}: \text{There is no significant relationship between dividend growth and P/E ratio.}\]

\[H_{02}: \text{There is no significant relationship between dividend payout ratio and P/E ratio.}\]

\[H_{03}: \text{There is no significant relationship between dividend yield and P/E ratio.}\]

\[H_{04}: \text{There is no significant relationship between earnings growth and P/E ratio.}\]

\[H_{05}: \text{There is no significant relationship between leverage and P/E ratio.}\]

\[H_{06}: \text{There is no significant relationship between net asset value per share and P/E ratio.}\]

\[H_{07}: \text{There is no significant relationship between return on asset and P/E ratio.}\]

\[H_{08}: \text{There is no significant relationship between return on equity and P/E ratio.}\]

\[H_{09}: \text{There is no significant relationship between size and P/E ratio.}\]

\[H_{10}: \text{There is no significant relationship between tobin’ Q and P/E ratio.}\]

e. Research Model:
The following equation is developed to answer the research question of this study:

\[
P/E = \alpha + \beta_1 \times (DG)_{t-1} + \beta_2 \times (DPR)_{t-1} + \beta_3 \times (DY)_{t-1} + \beta_4 \times (EG)_{t-1} + \beta_5 \times (Lev.)_{t-1} + \beta_6 \times (NAVPS)_{t-1} + \beta_7 \times (ROA)_{t-1} + \beta_8 \times (ROE)_{t-1} + \beta_9 \times (SZ)_{t-1} + \beta_{10} \times (TQ)_{t-1} + \epsilon_{t-1}
\]

Where,

\[
\begin{align*}
\text{DG} & : \text{Dividend growth} \\
\text{DPR} & : \text{Dividend payout ratio} \\
\text{DY} & : \text{Dividend yield} \\
\text{EG} & : \text{Earnings growth} \\
\text{Lev.} & : \text{Leverage} \\
\text{NAVPS} & : \text{Net asset value per share} \\
\text{ROA} & : \text{Return on asset} \\
\text{ROE} & : \text{Return on equity} \\
\text{SZ} & : \text{Size} \\
\text{TQ} & : \text{Tobin’ Q} \\
\epsilon & : \text{Error} \\
\beta_1 - \beta_{10} & : \text{Coefficient}
\end{align*}
\]

5. RESULT AND DISCUSSION:
a. Descriptive statistics and Correlation matrix:

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
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<td>30.02</td>
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<td>0.51</td>
<td>0.23</td>
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</tr>
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<td>0.25</td>
<td>0.46</td>
</tr>
<tr>
<td>SZ</td>
<td>6.85</td>
<td>10.69</td>
<td>9.25</td>
<td>0.76</td>
</tr>
<tr>
<td>TQ</td>
<td>0.08</td>
<td>31.16</td>
<td>2.76</td>
<td>4.79</td>
</tr>
</tbody>
</table>
Table 1 depicts the descriptive statistics of the sample which includes the minimum value, maximum value, mean value and standard deviation. Price earnings ratio shows a mean value of 30.02% and standard deviation of 19.64%. Though the minimum value of P/E ratio is 2.43% but the mean value is satisfactory for the investors. NAPVS has highest standard deviation i.e. 443.49%, which indicates the high volatility. Leverage has the lowest standard deviation among all the variables. This indicates that during the study period, the listed manufacturing firms of DSE have same proportion of debt in respect of the total assets. Average dividend growth i.e. 1.35% indicates that selected companies have a positive dividend growth.

Table-02: Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>P/E</th>
<th>DG</th>
<th>DPR</th>
<th>DY</th>
<th>EG</th>
<th>Lev.</th>
<th>NAVPS</th>
<th>ROA</th>
<th>ROE</th>
<th>SZ</th>
<th>TQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>P/E</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DG</td>
<td>0.002</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPR</td>
<td>-0.022</td>
<td>0.090</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DY</td>
<td>-0.109</td>
<td>-0.072</td>
<td>-0.183</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EG</td>
<td>-0.115</td>
<td>0.310**</td>
<td>-0.023</td>
<td>0.086</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lev.</td>
<td>0.105</td>
<td>-0.147</td>
<td>0.023</td>
<td>-0.016</td>
<td>-0.032</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAVPS</td>
<td>0.232**</td>
<td>-0.061</td>
<td>-0.060</td>
<td>-0.101</td>
<td>0.002</td>
<td>-0.006</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROA</td>
<td>-0.099</td>
<td>0.057</td>
<td>0.287*</td>
<td>-0.135</td>
<td>0.019</td>
<td>-0.232</td>
<td>0.059</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROE</td>
<td>-0.084</td>
<td>-0.012</td>
<td>0.117</td>
<td>-0.103</td>
<td>0.049</td>
<td>0.192*</td>
<td>0.176</td>
<td>0.459**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SZ</td>
<td>-0.397**</td>
<td>0.130</td>
<td>0.181*</td>
<td>-0.189*</td>
<td>0.124</td>
<td>-0.041</td>
<td>-0.013</td>
<td>0.294**</td>
<td>0.194*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TQ</td>
<td>-0.080</td>
<td>-0.022</td>
<td>0.030</td>
<td>0.185*</td>
<td>-0.024</td>
<td>-0.171</td>
<td>-0.145</td>
<td>0.475**</td>
<td>0.198*</td>
<td>-0.014</td>
<td>1</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 2 is showing correlation coefficients between sets of variables. Net asset value per share (NAPVS) is showing a significant positive relationship with P/E ratio and this relationship is significant at 1% level of significance. If NAPVS of the firms increase, then P/E ratio will increase and vice versa. Size has a significant negative relationship with P/E ratio at 1% level of significance. P/E ratio has insignificant positive relationship with dividend growth and leverage but insignificant negative relationship with dividend payout ratio, dividend yield, earning growth, return on asset, return on equity and tobin’s Q.

b. Regression analysis:

Table-03: Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.513*</td>
<td>.263</td>
<td>.213</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), TQ, SZ, EG, NAVPS, Lev, DPR, DY, DG, ROE, ROA

Table shows the overall fitness of the study. The value of R² measures how much of the variation in the dependent variable can be explained by the independent variables. Results indicate that the selected variables can explain 26.3% variation of P/E ratio.

Table-04: Analysis of Variance b

<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>15842.868</td>
<td>10</td>
<td>1584.287</td>
<td>5.219</td>
<td>.000*</td>
</tr>
<tr>
<td>Residual</td>
<td>44320.587</td>
<td>146</td>
<td>303.566</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>60163.456</td>
<td>156</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), TQ, SZ, EG, NAVPS, Lev, DPR, DY, DG, ROE, ROA
b. Dependent Variable: PE

F value is significant at 1% level of significance (i.e. F test: 5.219; Sig: 0.000). This indicate that the overall model is significant, so the independent variables have a relationship with P/E ratio.

Table-05: Coefficients analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>118.930</td>
<td>17.977</td>
<td>6.616</td>
<td>0.000</td>
</tr>
<tr>
<td>DG</td>
<td>0.397</td>
<td>0.320</td>
<td>0.095</td>
<td>1.239</td>
</tr>
<tr>
<td>DPR</td>
<td>0.800</td>
<td>2.899</td>
<td>0.021</td>
<td>0.276</td>
</tr>
<tr>
<td>DY</td>
<td>-1.802</td>
<td>0.948</td>
<td>-0.146</td>
<td>-1.900</td>
</tr>
<tr>
<td>EG</td>
<td>-0.261</td>
<td>0.278</td>
<td>-0.071</td>
<td>-0.940</td>
</tr>
</tbody>
</table>

http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7624 www.ijsrp.org
Regression coefficient results are shown in the above table. Results show that some variables have insignificant relationship where others have insignificant relationship with P/E ratio. Dividend yield has statistically significant impact on P/E ratio. Coefficient of dividend yield indicates a negative impact and theoretically this relationship is also valid because the denominator of dividend yield is the numerator of P/E ratio. Leverage has significant positive impact on P/E ratio. Theoretically this is correct if the inclusion of debt decrease the earning capacity of the firm. Again if the inclusion debt increases the earning capacity, then P/E will also increase but this would be possible in the long run. Because usually market will take some time to realize the earning potentiality of that respective firm. Net asset value per share has significant positive impact on P/E ratio. This empirical result is also consistent with theory because if the number of outstanding share remains constant then an increase in NAVPS will results an increase in asset directly or indirectly. This will create a positive perception among the investors, though an increase in the earnings may lower the P/E ratio but this will ultimately increase the share price at a large scale resulting higher P/E ratio. Empirical result is showing that size has a significant negative impact on P/E ratio reflecting that investors are more willing to invest in small firms.

CONCLUSION

Share valuation is a prerequisite for the investors in making investment decisions. From investor’s perspective, they try to measure the actual value of stock so that they don’t lose their invested funds. But from company’s perspective, it tries to make positive perception about its stock among the investors. P/E ratio is a medium for both parties to communicate with each other. P/E ratio simply indicates the share price against earning. In normal sense, higher P/E ratio indicates better position of a firm and vice versa. So a firm may increase P/E ratio by reporting less earnings less than actual figure if it wants to make foolish the investors. Determinants of P/E ratio may be irrelevant for technical analysts. But no scope is left for fundamental analysts to overlook the relevancy of determinants in valuing P/E ratio. Valuing the listed manufacturing firms, now investors may consider the dividend yield, leverage, size and net asset value per share as the most significant determinants of P/E ratio. But this article is failed to reveal the significance of other selected variables i.e. dividend growth, dividend payout ratio, earnings growth, return on asset, return on equity, tobin’s Q as the determinants of P/E ratio. Because some selected samples were deducted due to unavailability of data. The selected variables don’t cover all possible factors. In spite of these limitations, still this article is an empirical evidence for the fundamentals analysts.

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Android Based Citizen Service Mashup System (CSMS)

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Abstract- India is the World’s largest democracy, with 1.25 billion people governing the nation. Problems in organization influencing everyday existence of native will undoubtedly happen. With government help and altruism of other national, these can be comprehended. Thus, government declares lead-plans covering the advantages of individuals who requires little push to advance in life. Online Mashup system permits both the administration staff and citizens of India to impart, propositions arrangements and collaborate over the issues. No such solution exists starting at now, consequently proposed framework will make a powerful organization, cognizant nationals and fruitful government. A Concentrated mashup will ensure that everyone of the issues of the citizens are recorded alongside, it will act as repository to derive a conclusion about the resolvement and it will act as helping hand to the strategy maker. This framework appears in light of the fact that a citizen wants to repost an issue he has to go through the tedious job of submitting the application and the response of organization is moderate because of sheer number of such complaints and their handling. This framework will make all the written application digitized and furthermore take into consideration of quick activities. This solution will make governance Simple, Moral, Accountable, Responsive, Transparent (SMART). Written application at it as least prompting simplicity of responsibility, lessening, perplexity, increase in work rate and effectiveness.

Index Terms- Real time tracking, accident detection, reporting, traffic, safety, anti theft, potholes, security, vehicle accident.

I. INTRODUCTION

The municipal bodies of India are vested with a long list of functions delegated to them by the state governments under the municipal legislation. These functions broadly relate to public health, welfare, regulatory functions, public safety, public infrastructure works, and development activities. Public health includes water supply, sewage and sanitation, eradication of communicable diseases. Welfare includes public facilities such as education, recreation. Regulatory functions relate d to prescribing and enforcing building regulations, encroachments on public land, birth registrations and death certificate. Public safety includes fire protection, street lighting. Public works measures such as construction and maintenance of inner city roads. In addition to the legally assigned functions, the sectorial departments of the state government often assign unilaterally, and on an agency basis, various functions such as family planning, nutrition and slum improvement, disease and epidemic control. The CSMS framework permits client confronting a similar issue to report it again and subsequently expanding its earnestness each time another client reports a similar issue. This implies numerous clients are confronting similar issue, henceforth it should take the priority for arrangement execution of same. Likewise, the characteristics of the issue are captured by the CSMS framework instead of depending on the human side of the judgement. The traditional framework does not permit the citizen who has reported the issue to monitor the issue resolvement process and hence organization can hang that issue in between and declare it as completed. The CSMS framework has the feature that enables organization to transfer photo of whatever work is done during the Service Level Agreement (SLA). Citizen uploaded photos will be opened subsequently to whoever has reported a similar issue and will be able to see the improvement in repair work.

II. LITERATURE SURVEY

1. Vijaya Bhaskar, Gowri Manohar (2016)
“Surface pothole depth estimation using stereo mode of image processing”
International Journal of Advanced Research in Engineering and Technology
In this Research paper author Vijaya Bhaskar and Gowri Manohar explain the estimate the depth of the pothole and other attributes by the use of stereopsis algorithm. Author’s approach is aimed at pothole depth estimation in stereo mode of image processing via un-calibrated mode of rectification. Reasonably accurate calculations of pothole mean depth value have been estimated using the algorithm. Thus future work can be carried out using calibrated rectification methodology for depth estimation to improve accuracy. Also, a mobile navigation system can be designated to interface with the vision system in dynamic environment.

“Pothole Detection System using a Black-box Camera”
Multidisciplinary Digital Publishing Institute
In this Paper author Youngtae & Seungh Ryu explains a new pothole detection system using a commercial black-box camera. The proposed system detects potholes over a wide area and at low cost. We have developed a novel pothole-detection algorithm specifically designed to work with the embedded computing environments of black-box cameras. Experimental results are presented with our proposed system, showing that potholes can be detected accurately in real-time. The proposed pothole-detection algorithm was designed and implemented in consideration of the limited computing power of the embedded
systems in black-box cameras. The experimental results demonstrate that the proposed algorithm can correctly remove various types of similar objects, such as patches, manholes, shade, and moving vehicles. By doing so, pothole regions can be detected correctly. The overall sensitivity and precision reached 71% and 88%, respectively. Thus, the algorithm is considerably robust to similar objects. In some cases, however, the proposed system failed to detect potholes that were especially bright or flat.

3. Li, J. Gong
   “Mashup: a new way of providing web mapping/GIS services”

International Society for Photogrammetry and Remote Sensing

In this paper, author S. Li and J. Gong explains current development in mashup technologies, such as Google Map, Yahoo! Map, and MapQuest in the context of map mashups, and presents a classification of map mashups. Both technical and social issues related to the map mashup development and uses are discussed, with examples of case study mashups. The results demonstrate that map mashup has great potential to improve and facilitate the rapid development of the future web mapping/GIS services, such as participatory GIS and e-government services. However, issues related to data ownership, privacy protection, and some limitations inherent to the current mashup technologies need to be solved before its wider adoption.

III. IMPLEMENTATION

Classifying the image into 2 categories(pothole/garbage):

Most popular machine learning library is Google. A library is a collection of precompiled routines that a program can use. The routines, sometimes called modules, are stored in the object format. Libraries are particularly useful for storing frequently used routines because you do not need to explicitly link them to every program that use them. For example, in our case routine is detecting a particular feature of an image such that the machine will be able to tell which category it belongs to. For achieving this we are executing a particular workflow again and again and hence instead of writing as separate module each time we import this library in our lines of code. Every single product nowadays uses machine learning in one way or another. It may be image search, image captioning, translation, recommendation, etc. In short, where there is a large chunk of data involved machine learning can be very helpful. For example, a Japanese cucumber farmer used machine learning to classify if cucumber he produces was one of the nine species. Image classifier using machine learning involves following stages:

1. Setup a library
2. Get training data and feed it to library
3. Classify

Now while getting the training data depending upon the situation one might not find training data with same parameters for example, in our case we are training the machine to identify whether provided image is pothole or garbage, the training data involves is images of garbage and pothole. Now there is no way possible that in all the images machine finds equal light intensity or similar angle and heading or size of the pothole since these images can be clicked at different times of the day or with different geological headings and size or shape of two pothole are never the same. Here we use neural network. They are essential a black-box that construct features that construct that we otherwise have to handcraft and the abstract features they produce are so generalized that they account for variables. Following is the architecture of how CNN works suppose it has been fed an image, it does Convolution and Pooling. Convolutional: Convolutional layers apply convolution operation to the input, passing the result to the next layer. Convolution emulates the response of an individual neuron to visual stimuli. Each convolutional neuron process data only for its respective field. Although fully connected feed forward neural network can be used to learn features as well as classify data, it is not practical to apply this architecture to images. A very high number of neurons would be necessary, even in a shallow (opposite of deep) architecture, due to the very large input sizes associated with images, where each pixel is a relevant variable. For instance, a fully connected layer for a (small) image of size 100x100 has 10000 weights. The convolution operation brings a solution to this problem as it reduces the number of free parameters, allowing the network to be deeper with favour parameters, for instance, regardless of image size, tiling regions of size 5x5, each with the same shared weights, requires only 25 learnable parameters. In this way, it resolves the vanishing or exploding gradients problem in training traditional multilayer neural networks with many layers by using back propagation.

Pooling: Convolutional networks may include local or global pooling layers which combine the outputs of neuron clusters at one layer in to a single neuron in the next layer. For example, max pooling uses the maximum value for each of the clusters of neurons at the prior layer. Another example is average pooling which uses the average value from each cluster of neurons at the prior layer. An examples of this structure is shown in figure 2 where the CNN extracts features of Sara’s face and stores it. The only problem is if we want to train CNN ourselves for our private category we need lot of time and lot of computing power both which we don’t have hence we use a pertains CNN model provided by Google called Inception. Inception was trained by Google on 1 00k images across 1000 categories pothole not being one of them hence we need to apply a process called Transfer learning, it means applying the learning from previous learning session to a new training session.

![Fig. 1](http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7625)
IV. EXISTING SYSTEM

There are different approaches to report the issue, some of them are conventional, such as filing an RTI written application, technical method as visiting ULB’s website and documenting an issue caused in your area and so on. Citizen can go to MCGM portal and then select Complaint from toolbar and then Register a Complaint. After choosing the language Citizen fill form called complaint registration form which includes all the information about the complaint. This will generate a form in the database which will be visible to ULB having following fields,

1. Complaint Type
2. Complaint Subtype
3. PPO number
4. Description in brief
5. Location Of complaint
6. Name of complainant

The data will be provided by citizen from every corner of the city, maintained in traditional database of ULB. Once the repair work is done the concerned citizen or the citizen who filed a complaint will be notified and he can go and inspect the problem based location once again. These methods for filing an issue may vary for various bureaucracies. The Public Works Department (PWD) reviews the area between two locale and inside those locales, ULB defines the framework to report the problem.

The ‘Meri Sadak application’ proposed by Government of India comes in the jurisdiction of PWD. Spothole is an android based application developed by private organization, exclusively focusing on the metropolitan area; particularly Municipal corporation of Greater Mumbai (MCGM). The conventional framework including RTI, even if it promises definite results it is not effective since it is time and asset consuming, also this method is exceptionally hard to be comprehend by common citizen without the help of any legal advisor. ULB’s website is additionally insufficient since it cannot work as effectively as an android application. Furthermore, it requires every last detail of the complainant to be filled.

VI. PROPOSED SYSTEMS

The CSMS framework will connect the citizen straightforwardly administration association in charge of the foundation consequently there will be immediate contact between the administrative officer and the citizen likewise there won’t be any third party involved, for example, lawful counsel or any administrative officer, thus it will spare the assets and time. The CSMS framework gives a 3 stage technique which is easy to be comprehend for the common citizen and effectively report the issue. Whatever work is taken up by the ULB, is accessible for the general population. The concerned national can check the progress of repair work and the clients who have reported the issue will be informed periodically as the time assigned in SLA goes on. The greatest preferred standpoint if this framework is that it will convey an unprejudiced judgment when the time period ends and clients can thoroughly depend on that and there won't be any wrongdoings. In addition to that the CSMS system will have functionality of automatically detecting all the attributes associated with the problem and rate the problem accordingly such that governing body will be able to understand seriousness of the situation prioritize tasks accordingly instead of solving problems, which are not so serious first and solve the serious problems later just because there is lack of proper work scheduling system.
To identify new categories i.e. Pothole and Garbage

Comparing Pre and Post image:
Comparing two images is a vague task even though they are clicked in the same environment since there are so many objects, attributes etc. involved which when clicked from a different angle (particularly in our case) will appear the same to human eye but treated differently by machine.

Hence for comparing two images we take one of the properties of it and we go ahead, and for that histogram is used

A histogram is a graphical representation of total values of your image. In other words it shows the amount of tones of particular brightness found in the image ranging from black (0 % brightness) to white (100 % brightness).

Histogram of an image actually contains, In fig 5 it is the model of how histogram looks like. Here x axis is the intensity from 0-255 and y axis is no. of pixels for e.g. dark picture will have more no of pixel occupying lower intensity values here the peak value lies in left extreme region whereas white image has peak value of extreme right end. And in between the 0-255 is the gradient of intensities from black to white transition

VII. ADVANTAGES OF PROPOSED SYSTEMS

The proposed system will have following functionalities,

1. Visible to other public residing in that locality
2. System to report similar problem multiple times by multiple citizen and act accordingly
3. No manual efforts to report the problem, Problem reporting possible just by clicking a picture (Auto detection of attributes, Auto Location detection)
4. Facility for citizen to go to higher authority if his complaint is not acted upon
5. Impartial final judgement delivered by the system
6. Mechanism to enable the system to record attributes of problem
7. Easily Accessible system even when internet is not detected
8. Every Infrastructure should be able to get reported to the concerning facility i.e. ULB or PWD

VIII. METHODOLOGY

1. To implement a new features the developers need to lose only the work of a few days, or even only hours, to roll back and implement it.

2. Unlike the Waterfall model, in agile model very limited planning is required to get started with the project. Agile assumes that the end users needs are ever changing in a dynamic business and IT world. Changes can be discussed and features can be
newly affected or removed based on feedback. This effectively gives the customers the finished system they want or need.

3. Both system developers and stakeholders alike, find they also get more freedom of time and options than if the the software was developed in a more rigid sequential way. Having option gives them the ability to leave important decision until more or better data or even entire hosting programs are available; meaning the project can continue to move forward without fear of reacting a sudden standstill.

IX. CONCLUSION

This Project will serve as a useful approach to detect and calculate the depth of the Pothole and reporting it. It will enable to create and maintain updated database of detected potholes. It serves as a helpful approach for the government authority. It reduces the time taken to manually search and locate potholes. Our goal is to provide an accurate information about the location of the Pothole spotted.

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Web References


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The research is not financed

Abstract

Background: Early identification of life threatening signs of deterioration, timely escalation or reporting of the changes, coupled with timely review and management of the patient is fundamental in improving if not maximizing patient’s safety. Various studies have revealed that physiological anomalies exist before patients are rushed to intensive care unit or even succumb. Modified early obstetrics warning signs (MEOWS) chart is developed for the obstetric population for the purpose of enabling early signs of deterioration, timely escalation and review of patient. Study objective: To determine the influence of modified early obstetrics warning signs chart in early detection of obstetric emergencies by midwives at the Aga Khan University Hospital Nairobi. Methodology: Cross-sectional study design method was used. All nurses and midwives working in labour and postnatal wards were targeted. A total of 42 respondents were recruited from whom data was collected using a structured questionnaire. Systematic random sampling was done to get 321files with MEOWS chart. Two key informants participated in the study. Data was analyzed using Statistical Package for Social Sciences (SPSS) mainly by use of descriptive statistics. Descriptive statistics included mode, mean, median, standard deviation. Data was presented by use of graphs, pie charts and tables. Findings: Results showed that majority of respondents acknowledged that MEOWS chart enables early detection of obstetrics warning signs. Most users also indicated that Color coding, alerts them of possible signs of deterioration. Most respondents also, agreed that the chart provide clear instructions on escalation and prioritization of care. However, responds by doctors, to escalations within a duration of 10min was not always adhered to. Results from the charts revealed that documentation of physiological parameters and observable variables differences was key in early trigger of warning signs and timely escalations. Conclusion: Appropriate use of MEOWS enables early detection of obstetrics warning signs, timely escalation of triggers and management of patient.

Key words: Modified early obstetrics warning signs, Track, Trigger, and Escalation.

1. INTRODUCTION
Early warning signs (EWS) is a chart that uses physiological parameters to ‘track’ patient’s health state to identify early signs of deterioration and ‘trigger’ timely clinical intervention. Early warning systems provide quantifiable evidence that a patient’s condition may be deteriorating and more skilled clinicians must be notified to review the patient and advice on intervention. The cumulative MEOWS score rise as the patient condition deviates from normal, and values above a fixed threshold necessitates a call to the medical emergency team for review (MET). The major parameters scored are, temperature, pulse rate, blood pressure, respiratory rate, level of consciousness, oxygen saturation percentage, and urine output. Fixed set points in a color-coded chart trigger a nurse to escalate the assessment incidences by alerting the rapid response team or provider as a patient’s condition deteriorates. This allows for transfer to the intensive care unit in a timelier manner. To ensure that reliable, simple and comprehensive communication between nurses/midwives and SBAR model is used doctors. This model integrates well with the MEOWS by standardizing communication during escalation.

Previous studies have revealed that dismal vital sign documentation, poor documentation of deranged observation of major parameters, inadequate knowledge and, failure to react to unusual indicators, deficiencies in supervision and failure to escalate noted deterioration for assistance, have all added to the substandard healthcare of inpatients. It is documented that numerous insignificant deviations can lead to a major breakdown. When slightly deranged observations are assumed, major deviation occurs which are much more difficult to manage, leading to avoidable mortality or morbidity of inpatient. The MEOWS chart, having been successfully implemented and adopted as an assessment tool in obstetrics population at the Aga Khan university Hospital Nairobi called for the need to evaluate its impact in enabling early detection of obstetrics warning signs.

1.1 Specific objectives

To determine the influence of modified early obstetrics warning signs chart in early detection of obstetric emergencies by midwives at the Aga Khan University Hospital Nairobi.

2: Literature Review

2.1 Early detection of Obstetrics warning signs

CEMACH and other health organizations in the United Kingdom recommend implementation of MEOWS due to fears that rapid deterioration in obstetrics and maternal health may be undetected. The key to preventing devastating outcomes in pregnancy, labor and puerperium is by prompt detection of serious illness in the childbearing woman so as to make swift response, timely referral and achieve excellent care based on sound evidence.

It is necessary and urgent to routinely use the national MEOWS chart in all pregnant or postpartum women to aid recognition and treatment of those with confirmed or are experiencing rapid health deterioration. The physiological parameter cumulative scores on the chart should not only be documented but also used to activate appropriate response to improve or reverse the condition of the patient.

2.2 Reason for scoring

Bedside observations of vital signs charts are the backbone of identifying patient deterioration, however, observing and recording of physiological parameters remains in most cases poor. The monitored parameters observed during labor are interpreted individually for example, when the Cardiotocography is done documentation of the findings are mostly indicated in prose in the midwives notes, observations of vital signs are charted separately or written in prose in the notes or charted on a Partograph. This kind of documentation only allows for individualized interpretation of findings which is not related to findings in various charts or notes. Moreover, when parameters are documented individually they do not give obvious relationships to all the variables being measured. In this case, slightly deranged variables are, assumed as normal since they are not observed with all other variables that could also be slightly deranged. Combinations of many slightly deranged variables would be a trigger to early detection of deterioration of the mother, the fetus or both. Early warning signs can increase the chances of early escalation to the Rapid Response Team system by summing up physiological parameters that gives standard view of the patient condition. She said “We want to encourage recognition of high-risk patients as soon as possible”. The doctors cannot be effective if they are not called to the patient bedside in time.

Though a single-parameter method has been effective, supposing health institutions could recognize patients’ at-risk way before there is substantial change in vital signs? Imagine a system is put in place that can react to several parameters simultaneously and recognize patients at-risk at the earliest indication of a subtle change in observations of physiological parameters? Such an Early Warning Scoring System (EWSS), MEOWS etc., experts say, could produce more benefits for patients and health institutions by more timely detection deteriorating patients and timely referral of condition that could be fatal. In the transforming maternity services guide (2012) the National Health Services noted that there is prove that critically unwell patients or patient who become critically unwell while in health institutions could get substandard care. This could be as a result of non-recognition of deterioration or due to the fact that even if signs of clinical deterioration were noted they were not appreciated and no measures were taken to reverse the situation promptly.

Sometimes, a patient’s condition changes so incrementally that a nurse might not notice the danger in time to prevent a bad outcome. However, unless those changes are plotted on a visual map, especially a color-coded visual map, it may be difficult for a nurse to...
detect patient’s deterioration\textsuperscript{10}. A score is given to each parameter and added together to give a cumulative total. Hence, the higher the scores, the sicker the patient and the more urgent bedside review is needed to save the patient. A single significantly deviated parameter which denotes notable anomalies. For instance, a substantial change in blood pressure could lead to an escalation; subsequently a significant change in any other parameter might also prompt a call for review\textsuperscript{14}. In some cases, an instinct that something is wrong might lead to escalation without any documented prove or any scientific backing. Several team reports that, nearly 40\% of escalations are generated because the nurse senses that something is wrong with the patient\textsuperscript{15}.

2.3: Dissemination of MEOWS score Trigger
The absolute approach to get doctors’ attention and convince them to assess a patients during escalation is by giving measurable indication of deterioration\textsuperscript{16}. They further, added that measurable deviations help doctors to prioritize care. The chart increases team situation awareness and increase timely diagnosis and management\textsuperscript{17}. Unfortunately, some doctors do not necessarily believe that information documented by midwives on the charts support diagnosis, hence they do not pay attention to related findings\textsuperscript{18}. On the contrary, it was noted that observations charts are the most sought after nurse’s/midwives documentations by doctors. It is absolutely necessary for doctors to review patient at the stipulated time frame to increase the chances of complete recovery of the patient\textsuperscript{19}. Information in hospitals should be given utmost attention as the results of ignoring it is sometimes fatal\textsuperscript{20}. Recent studies indicated that communication among health workers in labour ward and postnatal ward is the key determinant of possible good outcome of the patient\textsuperscript{6}.

3 Study Methodology

3.1 Study design
Descriptive cross- sectional design was used to collect data from 42 nurses/midwives, and systematic random sampling method to get 321 MEOWS charts used to monitor mothers in labour. Two key informants participated in the study.

3.2 Validity and reliability of the data collection tools
Validity of the data collection tools was done by pre- testing of the questionnaires and checklists and adjustments done accordingly. To ensure study reliability, data was counter-checked during entry for completeness.

3.3 Data Collection
A self- administered semi structured questionnaire was used to collect data.

3.4 Quantitative data analysis
Statistical package for social sciences (SPSS) version 20 was used to analyze numerical data. Descriptive statistics; means, medians and their corresponding 95\% confidence intervals (95\%CI). Spearman’s correlation coefficients and corresponding p-values were calculated. The sent point of the level of significance was at 0.05. Bivariate analysis was done to determine relationships between variables.

3.5 Ethical consideration
Ethical clearance was obtained from the Mount Kenya University ethics board. Further, clearance was sort from Aga Khan University research and ethics board. The researcher also sought Permission from the maternity unit management to collect data. Prior to data collection, informed consent was obtained from the respondents. Participation was voluntary. Confidentiality of the data and information was maintained by use of protected secret passwords and used only for the purpose of the study.

4 RESULTS

4.1 Demographic Characteristics

<table>
<thead>
<tr>
<th>Age of group</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>29yrs and below</td>
<td>12</td>
<td>28.9</td>
</tr>
<tr>
<td>30 to 40 years</td>
<td>24</td>
<td>57.1</td>
</tr>
<tr>
<td>41 years and above</td>
<td>6</td>
<td>14.3</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>100</td>
</tr>
</tbody>
</table>
Respondents above 41 years were fewest at 6 (14.3%) followed by those below 29 years old at 12 (28.9%), most participants age ranged between 30 to 40 year 24 (57.1).

Table 2: Work station

<table>
<thead>
<tr>
<th>No</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>16</td>
</tr>
<tr>
<td>Post ward</td>
<td>15</td>
</tr>
<tr>
<td>Postnatal Pavilion Maternity</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
</tr>
</tbody>
</table>

Most of the respondents work in labour ward at 16 (39%) followed by general postnatal ward at 14 (34.1%) and Pavilion postnatal ward at 11 (26.8%).

Table 3: Duration of work in Maternity unit

<table>
<thead>
<tr>
<th>Duration of work in Maternity unit</th>
<th>No</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month to 2 Years</td>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>3 to 4 years</td>
<td>15</td>
<td>35.7</td>
</tr>
<tr>
<td>More than 5 Years</td>
<td>19</td>
<td>45.2</td>
</tr>
</tbody>
</table>

The smallest number of respondents 8 (19%) had worked in the unit for less than 2 years, 15 (35.7%) had worked for 3-4 years with the majority 19 (45.2%) had worked in the unit for more than 5 years.

4.2: Detection of warning signs

Table 4: Early detection of obstetrics warning signs

<table>
<thead>
<tr>
<th>Make it easier to detect early warning signs</th>
<th>Number of responses</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>2</td>
<td>5.1</td>
</tr>
<tr>
<td>yes</td>
<td>37</td>
<td>94.9</td>
</tr>
<tr>
<td>Give a comment to support the above your choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfavorable</td>
<td>3</td>
<td>13.6</td>
</tr>
<tr>
<td>Favorable</td>
<td>19</td>
<td>86.4</td>
</tr>
<tr>
<td>Ever nursed a patient who triggered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>20</td>
<td>47.6</td>
</tr>
<tr>
<td>Yes</td>
<td>22</td>
<td>52.2</td>
</tr>
<tr>
<td>If yes did the chart play any role in the warning</td>
<td>3</td>
<td>13.6</td>
</tr>
<tr>
<td>No</td>
<td>19</td>
<td>86.4</td>
</tr>
</tbody>
</table>

There was agreement by majority of respondents 37 (94.9%) that the MEOWS chart helps in the detection of early warning signs. However, a small minority 2 (5.1%) indicated that the chart does not help in early detection of early warning signs. Most respondents gave favorable comments 19 (86.4%) on the ease of early detection obstetrics warning signs while 3 respondents giving unfavorable comments. Most respondents 22 (52.2%) nursed patient with a trigger, the rest 20 (47.6%) did not have a trigger. Among those who nursed patients who triggered, majority 19 (86.4%) indicated that the MEOWS chart helped them in early detection of deterioration. However, a small minority, 3 (13.6%) indicated that the chart did not play a role in detection of deterioration.
Majority of the respondents 35(83.4%) agreed that the MEOWS chart is user friendly while 7(16.7 %) had contrary opinion. Most of the respondents 34(81.0%) admitted that the chart gives clear instruction the least disagreed on the clarity of the chart. Many respondents 31(73.8%) felt support to intuition while 11(25.2%) felt no support to intuition. A huge percentage 39 (92.8%) felt that the color codes alert them while 3(7.2%) did not concur. Majority of the respondents 34 (81.0%) agree that the chart enables them to prioritize care while 8(19%) disagree. Majority 33.0(78.6%) of the respondents agreed to the fact that the MEOWS enable decision to escalate, while 8.9(21.4%) are of the contrary opinion.

Most of the respondents 37(90%) indicated that the chart enabled team work while a small number of respondents 4(10%) indicated that the chart did not support team work.

4.3: Escalation of MEOWS trigger

Escalation of the deranged MEOWS score and quick review and management of the patient is key is successful use of the chart. Escalation is done by the nurses/midwives to doctors who are expected to review the patient within a stipulated period of less than 10 minutes.
4.3.1: Doctor response to trigger

To assess whether or not timely response to triggers is enhanced by use of the MEOWS chart. A question of responses from the doctors to review patients within stipulated time of 10 minutes after escalation was asked. Strongly disagree was rated at 1, disagree at 2, unsure at 3, agree at 4, and strongly agree at 5.

![Bar graph showing responses to whether doctors review patients within 10 minutes of escalation.]

**Doctors Response to triggers**

The smallest number of respondents 2(4.8%) strongly disagreed with the fact that doctors review patients within the recommended time frame upon escalation. Most of the respondents 7(40.5%) disagreed with that fact too. However, a small percentage 5(11.9%) were unsure. On the contrary, 14 (33.3%) agreed that review is done within 10 minutes while 4(9.5%) of the respondents strongly agree. Most of the respondents 24(57.1%) would not really count on the doctor to review the patient as recommended.

5 Discussion

5.1 Early detection of warning signs

The fundamental use of MOEWS is to detect early warning signs of deterioration of a patient and refer/call for review. Early detection is aided by increased score, the higher the score the more deranged the physiological parameter and hence the need to call for help. This increases patient safety and help avoid preventable morbidity and mortality. This study revealed that, 94.87% of the respondents indicated that the chart helps in early detection of early warning signs. This was reinforced by the key informants who said, “The MEOWS helps in identification and early referral of deteriorating patient for further management in intensive care unit”. The CEMACH recommended the adoption of MEOWS to aid early detection of deteriorating maternity patient. They added that it is easy to miss deterioration of the, maternity population due to increase in physiology reserve.

After noting deterioration CEMACH advises that swift mechanisms have to be put in place to reverse the situation. There are suggestions that MEOWS enables recognition of a deteriorating patient and enables a standardized method of escalation.

There is agreement that the MEOWS increases detection of early warning signs. Maternal morbidity and mortality is increasing in developing countries. To mitigate this, and improve the outcome of pregnancy use of MEOWS for early identification of warning signs was among the recommendations. MEOWS is used to assess mothers who may report being unwell during antenatal visit a high cumulative score enables the nurse to organize for meticulous follow up until the patient condition improves. MEOWS chart aided timely detection of signs of sepsis in postnatal ward and treatment was initiated immediately. There is increased possibility of identification of early warning signs when MEOWS chart is used, this is because the slightly deranged parameters are assessed in view of other parameters that might also show slight deviation; observed together these parameters my cause a trigger which may not be the case when observed individually. Obstetrics specific parameters included in the MEOWS increases the possibility of early detection of abnormalities.

Nurses/midwives intuition score included in the parameters allows the midwives to use his/her independent judgement of the condition of the patient. In this study, (31)73.8% of respondents agree to the fact that MEOWS support intuition. In many cases midwives increase the frequency of observation of patient even behold the hospital protocol. If their worries are quickly acted upon then many deaths would be avoided.
Post-partum hemorrhage is a very common obstetric emergency with well documented protocols of what to do once it is detected, all in all, several deaths are documented from this condition due to late diagnosis and underestimation of the severity of the condition. The study emphasized on the importance of early detection of warning signs with use of all measures available including updated tools and improvement on hospital systems. Majority of midwives (80%) indicated that using a MEOWS chart enabled them easily detect warning sign in postnatal patients.

5.2: Escalation of Triggers
Communication between members of staff is crucial in enabling usage of the MEOWS. Communication among respondents and between respondents and doctors is informed by SBAR model that is printed behind each MEOWS chart. Emphasis on proper communication among health workers is encouraged by many studies, other studies do not only encourage communication but also team work to enhance common understanding of patients.

5.3: Escalation among midwives and management
In earlier studies, the MEOWS chart was reported to increase team situation awareness and reduce delay in diagnosis and management of patient by midwives at Eastwards hospital. The over role health situation is given by a figure which means the same thing to everyone. Midwives especially in the post-natal ward were able to access all the information documented by their colleagues in labour and hence have a complete overview of the patient. This helps in planning for action of a possible reoccurrence of previous emergencies. A study done earlier, concurred with this finding citing that communication among health workers is key in improving safety of the patient. Comparable view that figures had a specific meaning regarding the over role health of the patient as opposed to written prose, and several charts that have only a number of parameters charted on them were also noted. Subsequently, the charts direct midwives upon recording the abnormal vital signs to alert senior midwives and doctors, facilitating shared understandings of deterioration and providing legitimacy for escalation of care. The use of a standardized manner of communication (SBAR) as indicated on the MEOWS also enables the respondents to improve on communication with each other. Improvement of communication among health workers using SBAR is highly adopted as a model to improve patient’s safety. The midwives are able to probe for further information in case something important is forgotten. Nonetheless, a huge percentage (87.7%) of nurses were found not to escalate triggers.

5.4: Doctor’s response to triggers
The essence of the MEOWS chart is to ensure that upon detection of deterioration a doctor is involved to review the patient and give further guidance on the management to avoid avoidable complications. Similar assessment done in a research indicated that when midwives escalated triggers doctors did not review the patient in time. They further, said that sometime they begged for patient to be reviewed. The outcome of the patient who has triggered fully depends on timely review by the doctor and management. The National Hospital Surveillance team in the United Kingdom advised that all patient with a trigger on MEOWS score must be reviewed at bed side by the available specialist even if he/she is not primarily the care giver. Earlier study findings resonated with this study finding on improved communication between nurses and doctors when using MEOWS chart, they agreed that the chart provides a nurse with straight forward, unmistakable means of communicating deterioration. MEOWS provides a chance to quantify all observation from every source giving a nurse a more informed reason to escalate. An assessment on the response of doctors to escalation; 85% of the respondent said that doctors would not review the patients in time, these findings resonate with our findings but the percentage in this case is remarkably high.

Conclusion
The study concluded that MEOWS enables early detection of obstetrics warning signs.

Recommendation
Timely review of patients within stipulated time should be optimized.

References


Effect of Different Coagulants on the Quality of Paneer Made from Cow Milk

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Abstract- This study was carried out to develop paneer with four different coagulants (Lime juice, Vinegar, Curd and Citric acid) using cow milk. Developed paneer were stored at 4 \textdegree C for 5 days and titratable acidity and pH were tested during the storage. Nutritional composition and microbial counts of paneer were analysed. Sensory evaluation was done for fresh paneer samples using five point hedonic scale. Titratable acidity and pH of paneer became significantly different (p<0.05) with storage time and they were in acceptable range, up to 4 days of storage at 4\textdegree C. Moisture, total solids, fat and ash contents of paneer did not significantly differ (p>0.05) with different coagulants. However, yield of paneer was significantly affected (p<0.05) by the coagulant and paneer prepared with curd reported the highest yield. Developed paneer was negative for pathogenic micro-organisms. According to the sensory evaluation, coagulants significantly influenced (p<0.05) the sensory attributes and paneer produced from citric acid received a higher rank for overall acceptability. Results of this study indicated that, paneer produced from cow milk with citric acid can be recommended as the best product.

Index Terms- Coagulants, Cow milk, Paneer, Storage, Whey

I. INTRODUCTION

Cow milk plays an important role in human nutrition since milk is one of the primary sources of nutrients in diets. In addition, milk contains various properties, which make it easy to convert into different milk products or to use it as an ingredient for other food items \cite{1}. Various human cultures have their own traditional ways of using milk and preparing different milk products. Paneer is a popular Indian soft cheese variety and nutritious and indigenous, dairy products, which occupy a prominent place among traditional milk products. According to the PFA \cite{2}, paneer means "product obtained from cow or buffalo milk or combination thereof, by precipitation with sour milk, lactic acid or citric acid". Paneer has a fairly high levels of fat, moisture, protein and low levels of lactose and minerals \cite{3}. It is used as the base material for the preparation of a large number of culinary dishes and it is a popular food product at the household level. Paneer is a rich source of animal protein available at a comparatively lower cost and forms important source of animal protein for vegetarians. Over and above its high protein content and digestibility, the biological value of protein in paneer is in the range of 80 - 86\% \cite{4}. Whey is a valuable by-product obtained during manufacture of paneer. It contains precious nutrients like lactose, whey protein, minerals and vitamins. These nutrients have an indispensable value in human dietary requirement \cite{5}. Consumption of the whey can supplement much of the lost organic and inorganic nutrients to the extra cellular fluid and utilization of these fluids can be targeted to the people working with strenuous occupation like sportsman, body builders, competitive athletes, exercising for pleasure and other people with similar kind of activity \cite{6}. Paneer is a vegetarian food item and there is a growing demand in the world for vegetarian food items at present. Even though paneer is highly nutritious with low production cost, it is not popular among Sri Lankans. Paneer can be easily manufactured using locally available coagulants at household level. Normally, buffalo milk is used to produce paneer and several researchers worked on producing paneer with cow milk. Therefore, aim of this study was to develop paneer with locally available coagulants such as lime juice, vinegar, curd and citric acid using cow milk and to evaluate the chemical composition of paneer whey.

II. METHODOLOGY

Raw materials
Fresh cow milk was obtained from the Livestock Farm, Veterinary Research Institute, Gannoruwa, Peradeniya, Sri Lanka. Four different coagulants; lime juice (citric acid), vinegar (acetic acid), curd (lactic acid) and citric acid were purchased from a local market.

Preparation of paneer
The average amount of coagulants required for coagulation was calculated from a preliminary study. Four replicates of paneer were prepared with each coagulant following the paneer production steps reported by Rao, et al. \cite{7}. One litre of fresh cow milk was used in each replicate.

Milk was heated separately up to 90\degree C for 10 min in a stainless steel vat. The heated milk was allowed to cool to 70\degree C and hot solutions of coagulants were added for each litre of milk with continuous stirring until there was a complete coagulation with clear whey separation. The coagulant curd was allowed to settle down for 5 min and the whey was allowed to drain using a
muslin cloth. The curd was transferred to hoops lined with muslin cloth and pressed (40 g / cm² for 10 min) to obtain a compact block of paneer. Then the yield of paneer was measured. The pressed block of curd was immersed in chilled water (4 - 5°C) for about 2 hrs. Then the product was removed from the chilled water and allowed to drain out the excess water. The paneer blocks were wrapped in polythene sheets and stored in the refrigerator at 4°C.

Each replicate was divided into equal portions (25 ± 3 g) and used for the evaluation of sensorial, physico-chemical, and microbial properties and shelf life.

**Sensory evaluation**
Prepared paneer samples were stored in a refrigerator and used for sensory evaluation in the next day. Each fresh paneer sample was evaluated using 30 non-trained (age = 22 – 25 yrs., sex = male and female) panelists for appearance, flavor, taste, texture and overall acceptability using a five-point hedonic scale.

**Physico-chemical analysis**
Paneer samples and whey were analyzed for various physico-chemical parameters viz., moisture, total solids and ash by gravimetric method, fat by Gerber method, pH by digital pH meter and titratable acidity by standard procedure described in AOAC [8]. Paneer was evaluated for moisture, fat and ash as described in AOAC [8]. The pH of paneer was determined by using a pH meter as the method described by Arora and Gupta [9].

**Shelf Life and microbiological analysis**
The developed paneer was stored in the refrigerator and analysed for changes in titratable acidity and pH immediately after preparation and at regular intervals in storage up to 5 days. Further, fresh paneer samples were analysed for desirable and undesirable (E. coli, yeast and mould counts) microorganisms by agar plate methods to assess the shelf life of the developed paneer.

Required amount of culture media (MPCA for bacteria, PDA for Yeast and mould, McConkey agar for E. coli) was taken according to the prescription and sterilized by autoclaving at 121°C for 15 min. Fifteen millilitres of prepared media were poured into petri dishes and allowed to solidify at ambient temperature. One gram of paneer sample was added into 9 mL peptone solution and mixed up (10⁻¹ dilution). One millilitre from 1st dilution was transferred into the tube with 9 mL peptone solution and 2nd dilution was obtained (10⁻² dilution). Then, 0.1 mL of samples from each and every dilution were poured into the petri dishes and spread. After that, dishes were transferred into the incubator and kept for overnight at 37°C and colonies were counted. Amount of colonies in 1 g of sample was reported.

**Statistical analysis**

Parametric data were analysed by one way Analysis of Variance (ANOVA) in Statistical Analysis Software [10]. Means were separated by Tukey’s Studentized Range Test (TSRT). Sensory data were analysed by Friedman non-parametric test in MINITAB 16.1.0 software package [11] with 95% confidence interval.

### III. RESULTS AND DISCUSSION

**pH of coagulants**
Several coagulants for making paneer; namely lemon juice, citric acid, tartaric acid, lactic acid, malic acid, hydrochloric acid, phosphoric acid, acetic acid, fermented milk, sour/cultured whey, yoghurt, and lactic cultures have been tested successfully by Kumar, et al. [12] and Sachdeva and Singh [13]. In this study, lime juice, vinegar, curd, and citric acid were used as coagulants to produce paneer and their pH were 2.21 ± 0.001, 2.72 ± 0.001, 4.01 ± 0.002 and 1.25 ± 0.001, respectively. Accordingly, citric acid was more acidic compared to the curd. Khan and Pal [14] reported that the strength of coagulant has an effect on the body and texture of paneer. Low acid strength results in soft body and smooth texture, while high acid strength results in hard body. Confirming their findings, paneer developed with curd yielded a soft body and a smooth texture due to the low acid strength of curd and paneer developed with citric acid showed a hard body texture due to the high acid strength of citric acid [14].

**Nutritional composition of fresh cow milk**
Total solid (11.4 ± 1.4%), fat (2.65 ± 0.35%) and ash (0.52 ± 0.01%) contents of cow milk used in this study were in line with the findings of Enb, et al. [15]. Further, moisture content, pH and titratable acidity in cow milk used in this study were observed as 88.6 ± 1.7%, 6.63 ± 0.02 and 0.16 ± 0.001, respectively.

**Sensory qualities of paneer**
Paneer made with four types of coagulants showed a significant difference (p < 0.05) for sensory attributes such as flavour and overall acceptability while appearance, taste and texture did not significantly different (p>0.05). Paneer developed with citric acid in this study also obtained better preferences (Figure 1). Rajashekar, et al. [16] reported that, paneer developed with citric acid yield superior paneer. Milk fat exerts significant effect on the organoleptic qualities of paneer. Hence, quality of paneer depends upon the quality of milk from which it was made. Though cow milk was used in our study, it contained 2.65% milk fat in average. The developed paneer with citric acid gave highest acceptable organoleptic qualities. However, Arva and Bhaik [17], observed less softness and flavou in paneer made from cow milk (2.2% fat).
Yield and nutritional composition of developed paneer

Yield of paneer developed from cow milk with different coagulants was significantly different ($p > 0.05$, Table 1). Paneer developed with curd had a significantly higher yield compared to those developed with other three coagulants. Yield of paneer is dictated by the composition of milk, given heat treatment, type and strength of coagulant, losses incurred after coagulation (based on pH and temperature of coagulation), and moisture content of resultant paneer after pressing [13, 18]. Therefore, observed differences in yield could be due to type and strength of coagulants used in the present study.

Moisture content, total solids, and fat content of paneer did not significantly differ ($p > 0.05$) with the type of coagulant used (Table 1). With contrast to our findings, Arya and Bhaik [17] reported that the fat content of paneer changes with different coagulants. Further, the observed total solids, fat and ash contents of paneer in the study were little less compared to the values reported by Masud, et al. [19] who prepared paneer using cow milk in which lactic acid was used as the coagulant.

Table 1: Yield and nutritional composition of paneer developed with different coagulants

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Lime juice</th>
<th>Vinegar</th>
<th>Curd</th>
<th>Citric acid</th>
<th>SE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (g)</td>
<td>132$^b$</td>
<td>134$^b$</td>
<td>166$^a$</td>
<td>120$^b$</td>
<td>18</td>
</tr>
<tr>
<td>Nutritional composition (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture</td>
<td>55.93</td>
<td>64.15</td>
<td>54.30</td>
<td>52.68</td>
<td>8.77</td>
</tr>
<tr>
<td>Total solids</td>
<td>44.07</td>
<td>44.29</td>
<td>45.69</td>
<td>47.32</td>
<td>4.3</td>
</tr>
<tr>
<td>Fat</td>
<td>19.83</td>
<td>20.00</td>
<td>21.88</td>
<td>21.63</td>
<td>4.83</td>
</tr>
<tr>
<td>Ash</td>
<td>1.58</td>
<td>1.79</td>
<td>1.91</td>
<td>1.23</td>
<td>0.54</td>
</tr>
<tr>
<td>Microbial counts (cfu)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total plate count</td>
<td>42 x 10$^3$</td>
<td>5 x 10$^3$</td>
<td>40 x 10$^2$</td>
<td>57 x 10$^2$</td>
<td></td>
</tr>
<tr>
<td>Yeast &amp; mould count</td>
<td>7 x 10$^1$</td>
<td>-</td>
<td>2 x 10$^2$</td>
<td>1 x 10$^3$</td>
<td></td>
</tr>
<tr>
<td>E. coli</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

$^a, b$ means within the same row with different superscripts are significantly different ($p < 0.05$)

* Standard error of means

Physico-chemical changes in developed paneer

The pH and titratable acidity of developed paneer were significantly affected ($p < 0.05$) by different coagulants (Figure 2 and 3). Further, there might be an interactive effect of treatments and storage time on pH and titratable acidity and they were within the acceptable range up to 4 days of storage at 4°C. In most of the developed paneer, pH decreased with storage time. In general, microbial count increases with the time and these microbes ferment lactose in to acid [20]. Therefore, with the time, acidity level increases and pH decreases.

Microbiological changes in paneer

According to IS: 10484 (1983) standards, the recommended total plate count, yeast and mould count and \( E. \) coli were \(< 5 \times 10^5\), \(< 250\) and \(< 90\), respectively. The developed paneer was negative for pathogenic microorganisms (Table 1). Aggarwal and Srinivasan [21] reported that microorganisms such as coliforms, yeasts and moulds that might be present in raw milk, get destroyed completely when milk is heated at 82°C for 5 min. However, these microbes may contaminate the product through a number of sources; air, water, equipment, knife, muslin cloth, and persons handling the products. If microbes can cause proteolytic and lipolytic changes, discoloration and other defects in the products would be possible [22]. Hence, it is very important to check the microbial counts in the developed product after preparation and during the storage.

Yield and nutritional composition of paneer whey

Yield and nutritional composition of paneer whey was not significantly affected \((p > 0.05)\) by different coagulants used (Table 2). In contrast, pH and titrable acidity were significantly different \((p < 0.05)\) when different coagulants were used and pH was significantly greater (acidity was lower) in whey resulted from paneer developed with vinegar and curd compared paneer developed with citric acid.
Table 2: Yield and nutritional composition of paneer whey

<table>
<thead>
<tr>
<th>Composition</th>
<th>Treatments</th>
<th>SE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (g)</td>
<td>Lime juice</td>
<td>651</td>
</tr>
<tr>
<td></td>
<td>Vinegar</td>
<td>653</td>
</tr>
<tr>
<td></td>
<td>Curd</td>
<td>764</td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>646</td>
</tr>
<tr>
<td>Moisture</td>
<td>Lime juice</td>
<td>91.88</td>
</tr>
<tr>
<td></td>
<td>Vinegar</td>
<td>92.21</td>
</tr>
<tr>
<td></td>
<td>Curd</td>
<td>92.31</td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>91.63</td>
</tr>
<tr>
<td>Total solids</td>
<td>Lime juice</td>
<td>8.12</td>
</tr>
<tr>
<td></td>
<td>Vinegar</td>
<td>7.79</td>
</tr>
<tr>
<td></td>
<td>Curd</td>
<td>7.69</td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>8.37</td>
</tr>
<tr>
<td>Ash</td>
<td>Lime juice</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>Vinegar</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>Curd</td>
<td>1.35</td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>1.14</td>
</tr>
<tr>
<td>pH</td>
<td>Lime juice</td>
<td>5.36³</td>
</tr>
<tr>
<td></td>
<td>Vinegar</td>
<td>5.48³</td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>5.48³</td>
</tr>
<tr>
<td></td>
<td>Curd</td>
<td>5.28³</td>
</tr>
<tr>
<td>TA</td>
<td>Lime juice</td>
<td>0.04³</td>
</tr>
<tr>
<td></td>
<td>Vinegar</td>
<td>0.1³</td>
</tr>
<tr>
<td></td>
<td>Curd</td>
<td>0.54³</td>
</tr>
<tr>
<td></td>
<td>Citric acid</td>
<td>1.23³</td>
</tr>
</tbody>
</table>

ab means within the same row with different superscripts are significantly different (p < 0.05)

* Standard error of means

IV. CONCLUSIONS

Different coagulants such as lime juice, vinegar, curd, and citric acid with cow milk can be used to prepare paneer with acceptable sensory qualities and nutritional compositions without any quality defects under refrigerated condition. However, overall acceptability of paneer and whey is greater when citric acid is used as the coagulant.

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A Review on Stabilization of Expansive Soil with various admixtures

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Abstract- Expansive soil or clayey soil which can change its volume when the water content is available i.e., swelling and shrinkage occurs. In urban areas, borrow earth is not easily available which has to be hauled from a long distance. Quite often, large areas are covered with highly plastic and expansive soil, which is not suitable for such purpose. It results on damage of building structures and road pavements due to its low strength and high expansion. The usage of admixtures can adversely improve the soil properties, thus stabilizing the clayey soil. A critical review on various admixtures used for stabilization of expansive soil is discussed in this paper.

Index Terms- Expansive soil, Fly Ash, Bagasse Ash, Coir waste, Lime

I. INTRODUCTION

An expansive soil is any soil that is prone to large volume changes i.e., shrinkage and swelling which is related to changing moisture conditions. Cyclical water ingress and removal causes moisture imbalance that triggers the “Shrink-Swell Cycle” [1]. This affects the foundation layer, runways, railways, roads. So, the soil property has to be improved through mechanical stabilization i.e., compaction. If not, the chemical admixture technique is used to achieve the desired strength. The addition of waste product can improve the strength properties of clayey soil. The expansive soil has two kinds of minerals i.e., original minerals and clay minerals. Original minerals (Quartz, Feldspar, Mica) are not considered due to their low amount and activity. Clay minerals (Montmorillonite, Illite, Kaolinite) are greatly influence the engineering properties of expansive soil. To reduce these minerals, different kind of admixtures such as bagasse ash, fly ash, coir waste, egg shell powder, quarry waste etc., can be used. These admixtures have the tendency to improve the engineering properties of soil.

Stabilization is the alteration of foundation soils to conform to desired characteristics or the improvement of a less stable soil in both strength and durability [2]. Stabilization can increase the shear strength of a soil and control the shrink-swell property of a soil, thus improving the load bearing capacity of a subgrade to support pavements and foundations. The main objective of this paper is to critically review the admixtures for stabilization of expansive soil.

II. REVIEW

A. Bagasse Ash

Bagasse ash is a fine residue collected from burning of bagasse fibers after crushing for sugarcane juice. Bagasse ash is a non-cohesive material having a low specific gravity and it comprises of high content of silica and since it burnt, it behaves as a pozzolanic material, thus it can be used for the stabilization of road subgrade [3], [4], [5].

Hydrated lime which has 85-95 % of calcium hydroxide [3] is an inorganic compound. The various tests are to be conducted with bagasse ash alone which in turns slightly it improves the strength of the clayey soil. The increase in strength of the combined hydrated lime-bagasse ash is higher than that of bagasse fibres employed alone [4], [5].

On the investigation with [3], calcium carbide residue is used as a admixture blended with bagasse ash to improve the strength of the clayey soil. CCR contains high CaO, so that it considered to be an admixture to reduce the plasticity index, expansion potential as well as to increase the shear strength and compressive strength of soil. The addition of bagasse ash to CCR significantly improves MDD, especially on 28 days curing time.
B. Coir Waste

Coir waste consists of coir pith and coir fibre is a by-product of coir manufacturing industry obtained from coconut husk during the extraction of coir fibre [6]. The various proportions are made for coir pith and coir fibre mixed with soil.

When the addition of coir pith alone to the soil in presence of water, it will absorb the water and fill the voids of soil thus contributing to the dry density. At higher coir pith content, the optimum moisture content increases. The coir fibre shows the similar result as that of coir pith. When both coir pith and coir fibre are used at a correct proportions with the soil, the maximum can be attained.

The CBR value attained for both soaked and unsoaked conditions increases with the increase in fiber content. Thus the significant increase in CBR value of soil due to the addition of coir fiber will substantially reduce the thickness of pavement subgrade [7]. From the review, it was found that the preparation of identical soil samples for CBR test beyond 1% of fiber content was not possible and optimum fiber content is found to be 1% by dry unit weight of soil.

The soil reinforcement is also a method to improve the bearing capacity and to reduces the settlement [8]. The square footing was prepared as a model by providing reinforced layer with various proportions of coir fiber. Therefore, the provision of coir reinforced layer increases bearing capacity and reduces settlement, which found to be economical techniques among various types of bearing capacity improvement techniques.

C. Egg Shell Powder and Quarry Dust

Egg shell powder has the similar chemical composition as that of lime, this can be used as the stabilizing material instead of using lime. From the domestic sources such as poultries, hatcheries and food centers are collected [2]. With the addition of ESP alone constantly, there is an increase in OMC and decrease in MDD. With varying percentage of ESP, shear strength increases, permeability increases. With the addition of optimum percentage of ESP and varying percentage of quarry dust, further increases the MDD and decreases the OMC and the shear strength, angle of internal friction increases and the cohesion decreases.

So, that the ESP alone with quarry dust used in combination with clayey soil possessed certain properties can be used for the improvement of clayey soil. From [9], the various tests are to be conducted to determine the optimum quantity of lime and the optimum percentage of lime ESP combinations. Here, the optimum quantity of lime is gradually replaced with amount of eggshell powder. It was found that, the lime stabilization is better than the combination of ESP and lime.

D. Fly Ash

The annual production of fly ash in India is about 184 million tons per year and also it increases day by day. Fly ash can be obtained from the combustion of sub-bituminous coal exhibit self-cementing characteristics. Fly ash treatment can effectively reduce the swell potential of highly plastic clay and thus prevents the swell beneath the small foundation pressure. For highly expansive clay, a combination of fly ash with small percentage of lime is recommended for stabilization [10].

The plasticity index of fly ash treated soils decreases mainly due to an increase in plastic limit. Liquid limit may increase or decrease depending upon the type of soil. The greatest problem occur in soils with a high montmorillonite content. Different clays have different susceptibility to swelling [11]. Fly ash itself has little cementitious value but in the presence of moisture it reacts chemically and improve the strength and compressibility of soils [12].

When the fly ash is added to the clayey soil, the California bearing ratio and unconfined compressive strength of the soil will be increased and thus improving geotechnical properties. Stabilization of weak soil with fly ash not only improves engineering properties of soil but also provides answers to issues of fly ash disposal [13].

D. Lime

Stabilizing expansive soil by adding lime is an ancient art and an age old practice, which has been followed all over the world. When lime is added to clayey soils provides an abundance of calcium magnesium ions, also sodium and potassium present on clay mineral plates. Lime stabilization has proved to be one of the most efficient techniques used to mitigate swell potential [14].
The chemical reaction occurring between lime and soil is quite complex. The stabilization apparently occurs as a result of two processes. In one process, the base-exchange occurs with the strong calcium ions of lime replacing weaker ions such as sodium. In other process, a change of soil texture flocculation of the clay particles takes place when lime is mixed with clays [15]. Due to the cationic exchanges, the lime can significantly reduce the swell potential. As lime content increases, there is significant improvement of silt fraction and reduction in clay fraction, free swell and swell pressure. The usage of lime alone can slightly increase the strength but not much than the admixtures which are added to the lime and soil mix[4]. The combination can adversely increase the stability of the soil than lime employed alone.

III. CONCLUSION

The clayey soil is a serious problem in construction which can be seen all over the world causes damages to the structures. The purpose of this study was to investigate the usage of admixtures in stabilizing the expansive soil. The following conclusion are studied from the review,

i. The strength increases when the addition of bagasse ash and lime with suitable proportions than treated with bagasse ash alone.

ii. Bagasse ash when mixed with CCR shear strength and compressive strength of expansive soil increases significantly.

iii. The engineering properties of soil can be stabilized by the usage of coir waste and the combined treatment i.e., coir pith and coir fiber increased the CBR value by 4.6 times.

iv. The shear strength, MDD, angle of internal friction increases and the OMC, cohesion decreases with the optimum percentage of ESP and increase in quarry dust.

v. The characteristics and strength of a highly expansive soil can be improved by fly ash stabilization.

vi. The fly ash treatment is effective in improving the plasticity index of the soil. Since there is much more fly ash that is disposed off rather than utilized making more productive use of fly ash would have considerable environmental benefits.

vii. Due to cationic exchange in lime stabilization, which lead to agglomeration and flocculation of soil, it causes significant effect in many properties of expansive soil such as plasticity index, compaction, swell potential, reduction of clay fraction and increase of silt and sand fraction.

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Assuring Total Quality Management across Educational Institutions: Evidence from Oman

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Abstract - To survive in this rapidly changing competitive service industry, service companies nowadays face a serious challenge to lead and keep upbeat with this dynamic environment. As education industry is a part of this service industry with students as its customers thus to reach high quality standards in this education commerce, we need concrete plans to counter this rapid changes. Therefore the Total Quality Management (TQM) tool comes into picture which will provide required quality to ensure business success. This research highlights imperative measures of TQM followed presently in higher institution of Oman and law makers has to invent viable education in Oman. Descriptive research design is adopted in this study help to know which variable is key for success in TQM implementation in teaching learning. The primary data was collected with structured questionnaire. In first part of questions related to demographic factors, secondly stakeholder’s efforts to implement TQM principles in educational institutions and finally dimensions of total quality management like top management commitment, customer focus, employee involvement and continuous process improvement (CPI). Based on the pilot study performed on 10 faculties from ministry colleges and 5 from private institutions, the questionnaires were administered. 300 respondents were selected based on the proportionate random sampling and 238 samples were considered for further analysis. Finally concluded that the faculty perception on successful implementation of total quality management principles in educational institutions is majorly influenced through providing of adequate resources for improving quality of education and encourages continuous improvement of curriculum, value added courses, teaching learning methodology and technology.

Keywords: Total quality management, Educational institution, attitude, top level commitment and change management.

I. INTRODUCTION

Brocka and Brocka [1] mentioned that TQM is a management method which is continuous in nature and involves fair amount of discussions at every level of operation to improve investment and resource performance by appropriate management. According to Toremen, Karakus and Yasan [2] organisations have well-defined intents and goals and thus they are integral part of other business sectors. Therefore they also need to observe every process of their organization to remain competitive and to accomplish best quality output. Thus to guarantee these aims and enhanced performance, adaptation of TQM tool becomes important [3]. Many studies reflect importance of TQM practices in manufacturing and service sectors. These TQM practices are called by different names such as “elements” by Waldman [4], “techniques” by Hellsten and Kelfsjo [5], “principles” by Sitkin et al. [6].

Higher educational institutions of western world is already using the TQM and adoption of this tool ensures them enhanced quality which directly helps in student intake from abroad as well as domestic which accounted for high profits through intake of foreign students [7]. Therefore this huge prospective of education industry has added great values benefiting the economic profits of western and other countries. However Malaysia is one country whose satisfactoriness as a global target is yet come although excellent tutoring are imparted in many countries globally. Therefore teachers’ observation towards the present
situation of TQM performance in Malaysian education organization to recognize the current obstacles which has gone unnoticed by the scholars till now has to be inspected [8].

II. TOTAL QUALITY MANAGEMENT IN EDUCATION INDUSTRY

According to Munoz [9], TQM can be used effectively in educational institutes having sole focus on increasing customer base. Recent researches mentions that using TQM as modern education management approach brings improvements and transformation in educational organizations [10]. Sallis [11] stated that reforms become a continuous process while applying these principles. TQM Processes are indistinguishable to the principles used by global finest schools [12]. Hamedoglu [13] and Sallis [11] mentioned that TQM is used differently in average & finest schools. One uses it as standpoint and other to eradicate the difficulties. In same lines Thiagarajan [14] noted that TQM is becoming respected quality pointer to measure quality of an educational institute.

A. Attitude towards Implementation

Lack of principles and modified approach toward execution of tasks by employees, is the concern area of educational organisations [15]. Difficult for the educational organisations to maintain and improvise the development process due to lack of proper documentations. Students are the end product in the education industry and as well the personnel gratification [10]. According to studies [16] [17] [18] lack of resources & comprehension, the approach and leadership commitment had made the implementation of TQM difficult.

B. Top Management Commitment

According to Sisman & Turan [19], as strong management and obligation to use best industry practices is significant for any organisation, thus the need to use TQM principles at respective level of organization is desired. Because of its human centric approach, TQM can assists in betterment of education quality and development of educational establishments [20]. Hashmi [16] mentioned that without satisfaction of human beings it is not viable to guarantee efficiency of educational establishments as human beings are products of these educational organizations and also key performers at all levels and all processes of these institutes. According to Lezotte [21], if organization aims to achieve high quality in education system, the basic level of human beings should be considered. Thus the people in higher management positions should be dedicated towards their personnel [19].

C. Employee Participation

It’s a known fact that employees are the most important segment of the organization performing tasks and work in reality. Thus according to Chapman & Al-Khawaldeh [22], employees participation in decision making process should be considered as they know things from root level. Also this will benefit in evading confusions between top management and employees. Apart from these, every increasing customers’ demands poses serious issue. This makes it actually difficult to meet both the deadlines and quality output [23]. Therefor according to Guimaraes [24], to archive higher efficiency, we need to recognize employees’ necessities. In similar lines Dahlgaard and Dahlgaard [25] noted that it is the responsibility of top management to decide what process & policies to include, what tasks are to be done and how to operate and organise business. Thus as they used to say in early days, to achieve successful business everyone should do what the top management decide.

D. Change Management

Absence of knowledge and abilities and amendments among teachers and managers required to implement TQM successfully [26][27]. According to Hamedoglu [13], the obstacles towards the effective TQM applications are educational, traditional,
III. RESEARCH METHODOLOGY

Descriptive research design is adopted in this study help to know which variable is key for success in TQM implementation in teaching learning. The primary data was collected with structured questionnaire. In first part of questions related to demographic factors, secondly stakeholder’s efforts to implement TQM principles in educational institutions and finally dimensions of total quality management like top management commitment, customer focus, employee involvement and continuous process improvement (CPI). In this study, the scale was used from previous work [2][24][29] five point likert scale for measurement of items. Respondents were asked to reveal their agreeableness and disagreeableness for the statement whereas 1= Strongly Disagree, 2=Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree.

Based on the pilot study performed on 10 faculties from ministry colleges and 5 from private institutions, the questionnaires were administered. 300 respondents were selected based on the proportionate random sampling and 238 samples were considered for further analysis.

Oman is divided into eleven governorates and these governorates are considered as different strata for the study. From these strata, the sample respondents were selected on a proportionate basis. Researcher took care while selecting the sample, so that there was a proportionate representation from each governorate. After arriving at the number of sample from each strata, the researcher applied random sampling method for selecting the sample. Researcher approached both Engineering and management colleges in each governorate on convenience sampling method.

IV. FACTOR ANALYSIS ON VARIABLES IMPLEMENTING TOTAL QUALITY MANAGEMENT

A. Testing of Hypothesis

Hypothesis 1: H₀ - Attributes are uncorrelated with implement TQM
Hypothesis 2: H₁ - Attributes are correlated with implement TQM

In order to identify the key factors which affect implementing TQM (H₁), exploratory factor analysis was performed and the results are shown in Table no. 1.

B. Kaiser-Mayer-Olkin (KMO) Measure of Sampling Adequacy

The KMO measures of sampling adequacy is an index used to examine the appropriateness of factor analysis. 0.50 was considered acceptable threshold for the study [29][30][32].

For our factor analysis, the KMO (table no.1) measure of sampling adequacy is 0.546, which is greater than the permissible value of 0.5. This also signifies that the scales of all the variables of the questionnaire were properly understood by all respondents and they have correctly answered to the scale. Additionally, the Bartlett’s Test of Sphericity has a high chi-square value and the significance is 0.000, which is less than 0.5. Hence the null hypothesis is rejected and H₁ is accepted, as the factors are correlated with each other.

<table>
<thead>
<tr>
<th>Table No. 1 - KMO and Bartlett’s test for variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaiser-Mayer-Olkin (KMO) Measure of Sampling Adequacy</td>
</tr>
<tr>
<td>Bartlett’s Test of Sphericity</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
The inter-item consistency reliability of these 26 variables was tested before factor analysis was carried out. The result for Cronbach’s Alpha test was 0.546 and no item deletion significantly increased the result. The closer the reliability co-efficient gets to the value of 1.0, the Bartlett is the reliability of the measures [31]. This scale can be considered to be good. Moreover, the result of both KMO and Bartlett’s test of Sphericity, i.e., significance value 0.000, also indicate that it was appropriate to apply the exploratory factor analysis techniques to this dataset. Result from the factor analysis shows that 68.024 percentage of variance was explained by these 26 extracted variables (table no.2).

<table>
<thead>
<tr>
<th>TABLE NO. 2 Component Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Component</td>
</tr>
<tr>
<td>1  2  3  4  5  6  7  8  9  10 11</td>
</tr>
<tr>
<td>Top management communication</td>
</tr>
<tr>
<td>-.512 .209 .189 -.117 .068 .243 -.263 -.107 .231 .111 .134</td>
</tr>
<tr>
<td>Top mgmt. anticipation</td>
</tr>
<tr>
<td>.128 .243 .257 .007 .157 -.252 -.372 -.561 .016 .081 .298</td>
</tr>
<tr>
<td>Adequate resources</td>
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</table>

Note: Extraction method: Principal component analysis; Rotation method: Varimax with kaiser Normalization; Rotation covered in 22 iteration
V. DISCUSSION

From the rotated component analysis (table no.2 & 3) there are eight major variables are loaded while applying the Extraction method in the Principal component analysis. In the analysis Varimax with kaiser Normalization method is used to identified the result in the 22 iteration. The detail results are discussed as follows.

Factor 1 loaded on first two variables. This can be labeled as “resource and improvement” as these two variables revealed the implementation of TQM principles and concepts in Oman educational institutions that allocate resources adequately for improving quality of education and continuous process improvement of curriculum, value added courses, teaching learning methodology and technology. Factor 2 correlated most highly with variable 3 i.e., measures the students quality through academic and non-academic performance.

Factor 3 correlated with variety of mechanism are used for seeking and learning customers’ needs and expectations. Factor 4 labeled as “Quality Education system”, based on head of the department ensures quality in all stages of work and educational system barrier in implementing TQM principles.

Factor 5 named as economic and cultural barriers, factor 6 named as lack of knowledge and skill is barrier to implement TQM effectively and factor 7 is loaded in top management anticipate future changes in industry and make plan to accommodate those changes in the institutions.

Factor 8 is labeled as customer identification and documentations, based on key customer requirements are identified through focus group discussion, industry institute interaction, industry visit and customer survey is one of the deciding factors for implementing TQM principles in Oman educational institution. And the standardized procedure for documentation in the institution is also a key deciding factor to implement TQM.

Other factors for implementing TQM in educational institutions are faculty participation in designing curriculum, steps to measures the stakeholders satisfaction, appraisal system for resigning and rewarding faculty, and finally measuring teaching learning quality.

VI. CONCLUSION

Finally concluded that the faculty perception on successful implementation of total quality management principles in educational institutions is majorly influenced through providing of adequate resources for improving quality of education and encourages continuous improvement of curriculum, value added courses, teaching learning methodology and technology.

ACKNOWLEDGEMENT

I would like to express my deep and sincere thanks to faculty those who are participated in this study. I thank the management of Muscat College for their support to do this study. Finally, my thanks to all the people who have supported us to complete this research study.

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Performance Analysis and Optimization of Cooling Tower

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Abstract- Cooling tower is an integral part of every thermal power generation plant. Basically cooling tower are heat rejection devices used to transfer heat from hot water to the atmosphere air. Investigation involves experimental and two-dimensional computational fluid dynamics analysis of an actual industry operated cooling tower. Inlet water temperature and mass flow rate of water and air are having main influence on the performance of counter flow induced draft cooling tower. Effectiveness of the cooling tower can be increased up to 20% by optimizing the liquid to gas ratio (L/G) of the cooling tower. Likewise other parameters such as range, tower characteristic ratio can also be increased considerably.

Index Terms- counter flow induced draft cooling tower, CFD analysis, tower characteristic ratio, range, effectiveness of cooling tower, liquid to gas (L/G) ratio.

I. INTRODUCTION

The cooling tower (CT) is the most important piece of industrial equipment whose primary purpose is to remove the heat while minimizing water usage. They are often used in power generation plants to cool the condenser feed-water. In cooling tower water is made to trickle down drop by drop, or form a thin layer over flat surface so that it comes into direct contact with air moving upwards in opposite direction. The heat transfer from the water to the air steam raises the air’s temperature and its relative humidity to 100% and this air is discharged to the atmosphere. As a result of this some water is evaporated and is taken away from the bulk of water, which is thus cooled. Thus evaporative cooling technique is used in the case of cooling towers. Cooling towers fall into two main categories: Natural draft and Mechanical draft. Mechanical draft towers are available in the following airflow arrangements: Counter flows induced draft, Counter flow forced draft. Cross flow induced draft. In the counter flow induced draft design, hot water enters at the top, while the air is introduced at the bottom and exits at the top. Both forced and induced draft fans are used. In cross flow induced draft towers, the water enters at the top and passes over the fill. The air, however, is introduced at the side either on one side (single-flow tower) or opposite sides (double-flow tower). An induced draft fan draws the air across the wetted fill and expels it through the top of the structure.in the present study the effect of various input parameters.

The cooling tower taken for the study is the cooling tower of an integrated titanium dioxide plant. The cooling tower used in this industry is a counter flow induced draft cooling tower. In this study we consider the effect of mass flow rate of air by adjusting the fan pitch angle. A 2D CFD model is created and is then validated with previously taken experimental values. This model is used to study effects of other input parameters of the cooling tower.

II COOLING TOWER CALCULATIONS

A cooling towers primary purpose is to remove heat and minimize water usage. Heat is transferred by two mechanisms. A portion of cooling water generally 1 to 3% actually evaporates as it readily mixes with air; latent heat is given up in this phase. Sensible heat transfer in which heat exchanged without a phase change makes up the balance. The relative humidity of the incoming air plays a great role in determining the rate of heat transfer.
According to thermodynamics

Heat removed from water = heat absorbed by surrounding air

\[ L (T_1 - T_2) = G (h_2 - h_1) \]

\[ \frac{L}{G} = \frac{(h_2 - h_1)}{(T_1 - T_2)} \]

Where,

- \( L \) = mass flow rate of water entering the tower
- \( G \) = mass flow rate of air through the tower
- \( T_1 \) = hot water temperature
- \( T_2 \) = cold water temperature

Temperature of air water vapor mixture at the inlet wet bulb temperature = 32.7°C

\( h_2 \) = enthalpy of air water vapor mixture at the exhaust wet bulb temperature = 98.4kJ/kg

\( h_1 \) = enthalpy of air – water vapor mixture at the inlet wet bulb temperature = 97.8Kj/kg

Relative humidity = 90%

The values of \( h_1 \) and \( h_2 \) are obtained from psychometric chart at 95% relative humidity corresponding to inlet and exhaust wet – bulb temperature of air-water vapor mixture.

\( L = 2400 \) cubic meter/hr.

The flow of water is regulated by using 4 pumps whose combined efficiency is 85% and each pump has capacity to regulate 600 cubic meter/hr.

Therefore \( L = 600 \times 4 = 2400 \) cubic meter/hr. the pumps are 85% efficient

Therefore \( L = 2400 \times (85/100) = 2040 \) cubic meter/hr.

Average hot water temperature to the tower and average cold water temperature from the tower checked in each hour a day for last 6 days is given below

<table>
<thead>
<tr>
<th>Day</th>
<th>Cold water temperature</th>
<th>Hot water temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/01/2018</td>
<td>33</td>
<td>41</td>
</tr>
<tr>
<td>9/01/2018</td>
<td>34</td>
<td>43</td>
</tr>
<tr>
<td>10/01/2018</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td>11/01/2018</td>
<td>31</td>
<td>40</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>33</td>
<td>42</td>
</tr>
<tr>
<td>13/01/2018</td>
<td>33</td>
<td>42</td>
</tr>
</tbody>
</table>

Table 1 Temperature reading (KMML CT)

Thermodynamics also dictate that the heat removed from the water must be equal to the heat absorbed by the surrounding air:

\[ L (T_1 - T_2) = G (h_2 - h_1) \]

Where \( L, G \) are the mass flow rate of water and air respectively

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www.ijsrp.org
Average cold water temperature (T₁) = 32.7°C, Average hot water temperature (T₂) = 41.3°C

Inlet wet bulb temperature of air T_{wb1} = 28, Exit wet bulb temperature of air T_{wb2} = 34

Corresponding to inlet and exit wet bulb temperatures the enthalpies are taken from psychometric chart

h₂ = enthalpy of air-water vapor mixture at exhaust wet-bulb temperature = 120KJ/KG

h₁ = enthalpy of air-water vapor mixture at inlet wet-bulb temperature = 94KJ/KG

566(41.3 – 32.7) = G (120 -94)

G = 187Kg/s

V = volume of air entering = 9008 cubic meter/minute

Calculation of Makeup water required:

Total loss = drift losses + evaporative losses + blow down losses + supply of hot water to MS plant

D = drift losses = 0.15% of water supply = (0.15/100)*2040 = 3.06 cubic meter/hr.

E = evaporative losses = 0.00085*water flow rate*(T₁ –T₂)

= 0.00085*2040*(41.3 – 32.7) = 14.91 cubic meter/hr.

Blow down losses = [E - {(C -1)*D}]/(C-1)

Where C = cycles = solids in circulating water / solids in making up water

Assume that the level of chlorides in the makeup water = 250ppm

And do not want level to go beyond 750 ppm14.91 cubic meter/hr.

Therefore blow down losses = [14.91 - {(3 -1)*3.06}] / (3-1)

= 4.395 cubic meter/hr.

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<th>Day</th>
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<tr>
<td>08/01/2018</td>
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<tr>
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<td>1094 cubic meter/day</td>
</tr>
<tr>
<td>10/01/2018</td>
<td>1131 cubic meter/day</td>
</tr>
<tr>
<td>11/01/2018</td>
<td>900 cubic meter/day</td>
</tr>
<tr>
<td>12/01/2018</td>
<td>692 cubic meter/day</td>
</tr>
<tr>
<td>13/01/2018</td>
<td>1123 cubic meter/day</td>
</tr>
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</table>

Table 2 Hot water supply to MS plant for 6 days

Average water supplied to MS plant = 1001 cubic meter/day.

= 41.7cubic meter/hr.

Therefore make up water required = 3.06 + 14.91 + 4.395 + 41.7 = 64.065cubic meter/hr.
Efficiency (E) = \[(\text{hot water temperature} - \text{cold water temperature})/ (\text{hot water temperature} - \text{wet bulb temperature})\]*100
= \[(41.3 - 32.7)/ (41.3 - 28)]*100
= 64.46%

**Analysis of air flow through existing aluminum alloy fan:**

Calculation of air velocity and flow rate through the cooling tower

Pitch angle (\(\phi\)) = 11°

Pitch distance = \(r\tan\phi = 6\tan11 = 1.166\)

Pitch distance and velocity are connected by the following relation,

\[1.166 = \frac{12V}{SRPM}\]

\(V = \text{air velocity (foot/minute)}\)

RPM (Rotations per minute) = 420

S (fan series) = 70

\[1.166 = \frac{12V}{70*420}\]

Air Velocity = 2795 ft/minute = 14 m/sec.

To calculate ACFM (Actual cubic flow per minute),

\[V = \frac{1.27\times(ACFM)}{\left(\text{DR}^2 - \left(\frac{S}{12}\right)^2\right)}\]

\(\text{DR} = \text{diameter of fan ring in feet} = 13\text{ft}\)

2795 = \[\frac{1.27 \times (ACFM)}{[132 - (70/12)]}\]

ACFM = 318082.5 Cubic feet per minute

= 9020 meter cube per min

**Analysis of air flow rate by variable pitch FRP fan:**

FRP fan used are variable pitch axial fan. And as the pitch angle increases the volume of air drawn by the axial fan also increases. As the mass flow of air increases the amount available to water molecules also increases, as a result the heat transfer rate also increases

Pitch angle (\(\phi\)) = 14°

Pitch distance = \(r\tan\phi = 6\tan14 = 1.495\)

\[2.75 = \frac{12V}{SRPM}\]
\[ 2.75 = \frac{12 \times V}{70 \times 420} \]

Air Velocity = 3665.12 ft./minute = 18 m/sec.

To calculate ACFM (Actual cubic flow per minute),
\[ V = \frac{1.27 \times (ACFM)}{DR^2 - \left(\frac{S}{12}\right)^2} \]

\[ DR = \text{diameter of fan ring in feet} = 13 ft \]

\[ 3665 = \frac{1.27 \times (ACFM)}{[132 - 70/12]^2} \]

ACFM = 416891.7 Cubic feet per minute

= 11804.9 meter cube

Percentage increase in volume flow rate of air = \[ \frac{(11804.9 - 9020)}{9020} \times 100 = 30.8\% \]

III NUMERICAL MODEL

The numerical analysis conducted is a multiphase model, consisting of two phases’ water and air. Air is considered as the working fluid. The flow is considered to be transient, turbulent with constant fluid properties. Evaporation and condensation technique is used. Condensation frequency is kept nil. Standard k-epsilon turbulent model is used due to the presence of high vorticities. The main objective of this study is to determine the effect of increased mass flow rate of air achieved by the use of FRP fans instead of aluminum alloy fans.

Effects of varying the mass flow rate of water and air along with the effect of inlet water temperature are studied. For optimizing inlet air temperature are kept constant and mass flow rate of water and air are taken as optimizing variables. The above mentioned conditions, together with the boundary conditions form a set of coupled non-linear partial differential equations and will be solved using FLUENT 15.5

Description of Model

A 2D CFD model of a counter flow forced draft cooling tower is made. Its dimension are cooling tower height 608 inches diameter of fan 144 inches, water inlet pipe diameter 8 inches, water basin length 400 inches, the cooling tower consist of 7 cells and the area of the fill is taken as 80900 square inches. Operating conditions include initial air velocity of 14 m/sec, volume flow rate of water 2040 cubic meter per hour, inlet water temperature of 314 K. The CFD model created is validated with the experimental results. And validated CFD model is used to determine the effect of inlet water temperature and effect of L/G ratio on heat transfer rate.

Geometry

Initially 2-D, CFD model of counter flow forced draft cooling tower is created considering important details some assumption were made to take into account the main features of real construction of cooling tower. 2-D symmetric model is developed; fixing the fill corresponding to real arrangement, Cooling tower shell is considered as a wall with zero thickness, Assuming symmetrical thermal and flow field in the model, only one half of the cooling tower is modeled with a symmetry boundary condition. The outlet of the peak cooler cells is created with rectangular cross- Reference conditions

➢ Tower height  15 m

➢ Air inlet height 5m, 10m
➢ Fill depth 1 m
➢ Tower basin diameter 10 m
➢ Water inlet height 11.5 m
➢ Water flow rate 0.566 l/s
➢ Water inlet temperature 314K, 316K
➢ Ambient air temperature 304K
➢ Ambient air humidity 60 %

Fig 1. Geometry

Generation of mesh

Much attention is to be paid with mesh quality requirement recommendation in FLUENT 15.5. In order to have an appropriate resolution of the flow field inside the cooling tower the computational domain is defined into a large number of finite volume cells. Different parts are meshed with different element sizing. Fill zone are fine meshed. By using mapped face meshing the model with appropriate element sizing is created. After mesh generation naming of different parts of cooling tower is done. Grid independence study is conducted to ensure quality of the CFD model. Orthogonal quality, skewness, etc. were in the acceptable range.
Table 3: Various cases studies

<table>
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<tr>
<th>Sl No</th>
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<tr>
<td>Case 1</td>
<td>Initial air mass flow rate of 9020 meter cube per minute and inlet water temperature of 314k</td>
</tr>
<tr>
<td>Case 2</td>
<td>Increased air mass flow rate of 11805 meter cube per minute and inlet water temperature of 314k</td>
</tr>
<tr>
<td>Case 3</td>
<td>Initial air mass flow of 9020 meter cube per minute and inlet temperature Of 316k</td>
</tr>
<tr>
<td>Case 4</td>
<td>Increased air mass flow rate of 11805 meter cube per minute and inlet water temperature of 316k</td>
</tr>
<tr>
<td>Case 5</td>
<td>Increased air mass flow rate of 11805 meter cube per minute and Mass flow rate of water is reduced to .512 meter cube per minute</td>
</tr>
</tbody>
</table>
Fig (3) for case 1

Fig (4) for case 2
Fig (4) for case 3

Fig (5) for case 4
RESULTS & DISCUSSIONS

The problem was modelled and solved in Ansys Fluent 15.5 and the results obtained are presented in Table 4. The Figure 4 shows the average outlet temperature of cooled water from the cooling tower in each case.

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Case</th>
<th>Average water outlet Temperature</th>
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<td>Case 1</td>
<td>Initial air mass flow rate of 9020 meter cube per minute and inlet water temperature of 314k</td>
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<td>Increased air mass flow rate of 11805 meter cube per minute and inlet water temperature of 314k</td>
<td>304.5k</td>
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<tr>
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<td>Initial air mass flow of 9020 meter cube per minute and inlet temperature of 316k</td>
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</tr>
<tr>
<td>Case 5</td>
<td>Increased air mass flow rate of 11805 meter cube per minute and Mass flow rate of water is reduced to 0.512 meter cube per minute</td>
<td>303.5k</td>
</tr>
</tbody>
</table>

Table 4 Average temperatures for each case

From the Table 4 we can see that for case 5 the average water outlet temperature of the cooling tower is minimum and is 303.5 K. This is when the volume flow rate of air is increased by 30% with respect to initial case and mass flow of water is reduced to 0.512 cubic meter per hour.
The heat transfer rate of the cooling tower depends on liquid to gas ratio and by optimizing the liquid to gas ratio its performance can be increased. Initially the (L/G) ratio was 3.25 (in case 1, case 3) and it is reduced to 2.60 (in case 2, case 4, case 5). As the (L/G) ratio is reduced the amount of air available for each water droplets increases and more amount of heat is transferred from the hot water to air. In case 3 and case 4 the effect of inlet water temperature is studied, in both the cases the Outlet water temperature is increased. So the water inlet temperature is an important factor in cooling tower design. Objective of this experiment was to increase the performance of the cooling tower. Mass flow rate of water and air were taken as the optimizing variables. In case 5 the both the mass flow rate of air and water are varied to improve its performance. Three performance parameters are used to evaluate each case. The parameters considered are:

1. Effectiveness - is the ratio of range, to the ideal range, i.e., difference between cooling water inlet temperature and ambient wet bulb temperature, or in other words it is = Range / (Range + Approach)

2. Range of cooling towers - Cooling tower range is defined as the temperature difference between inlet water and outlet water temperature

3. Tower characteristic ratio - In a cooling tower, the heat transfer takes place due to two phenomena involving the sensible heat transfer and the evaporative heat transfer. Evaporative heat transfer further involves the mass transfer of water vapor into the air. This cumulative effect of both the heat transfer processes is accounted by tower characteristic ratio

Calculation of performance parameters for each cases:

<table>
<thead>
<tr>
<th>Sl no</th>
<th>cases</th>
<th>Effectiveness of cooling tower = [(T1 – T2)/(T1 – WBT)]*100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cases 1</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>Cases 2</td>
<td>83</td>
</tr>
<tr>
<td>3</td>
<td>Cases 3</td>
<td>57</td>
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<tr>
<td>4</td>
<td>Cases 4</td>
<td>78</td>
</tr>
<tr>
<td>5</td>
<td>Cases 5</td>
<td>88</td>
</tr>
</tbody>
</table>

Table 5 effectiveness of cooling tower for each case

<table>
<thead>
<tr>
<th>Sl no</th>
<th>cases</th>
<th>Range of cooling tower (T1 – T2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cases 1</td>
<td>7.6</td>
</tr>
<tr>
<td>2</td>
<td>Cases 2</td>
<td>9.5</td>
</tr>
<tr>
<td>3</td>
<td>Cases 3</td>
<td>8.2</td>
</tr>
<tr>
<td>4</td>
<td>Cases 4</td>
<td>10.7</td>
</tr>
<tr>
<td>5</td>
<td>Cases 5</td>
<td>10.5</td>
</tr>
</tbody>
</table>

Table 6 range of cooling tower for each case
<table>
<thead>
<tr>
<th>Sl no</th>
<th>Cases</th>
<th>Tower characteristic ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cases 1</td>
<td>0.8324</td>
</tr>
<tr>
<td>2</td>
<td>Cases 2</td>
<td>1.297</td>
</tr>
<tr>
<td>3</td>
<td>Cases 3</td>
<td>0.732</td>
</tr>
<tr>
<td>4</td>
<td>Cases 4</td>
<td>1.484</td>
</tr>
<tr>
<td>5</td>
<td>Cases 5</td>
<td>2.068</td>
</tr>
</tbody>
</table>

Table 7 tower characteristic ratio of cooling tower for each case

### IV RESULTS & DISCUSSIONS

The problem was modeled and solved in Ansys Fluent 15.5 and the results obtained are presented in Table 4. The Figure 4 shows the average outlet temperature of cooled water from the cooling tower in each case.

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Case</th>
<th>Average water outlet Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1</td>
<td>Initial air mass flow rate of 9020 meter cube per minute and inlet water temperature of 314k</td>
<td>306.4k</td>
</tr>
<tr>
<td>Case 2</td>
<td>Increased air mass flow rate of 11805 meter cube per minute and inlet water temperature of 314k</td>
<td>304.5k</td>
</tr>
<tr>
<td>Case 3</td>
<td>Initial air mass flow rate of 9020 meter cube per minute and inlet temperature of 316k</td>
<td>307.8k</td>
</tr>
<tr>
<td>Case 4</td>
<td>Increased air mass flow rate of 11805 meter cube per minute and inlet water temperature of 316k</td>
<td>305.3k</td>
</tr>
<tr>
<td>Case 5</td>
<td>Increased air mass flow rate of 11805 meter cube per minute and Mass flow rate of water is reduced to .512 meter cube per minute</td>
<td>303.5k</td>
</tr>
</tbody>
</table>

Table 4 Average temperatures for each case

From the Table 4 we can see that for case 5 the average water outlet temperature of the cooling tower is minimum and is 303.5 K. This is when the volume flow rate of air is increased by 30% with respect to initial case and mass flow of water is reduced to 0.512 cubic meter per hour.

The heat transfer rate of the cooling tower depends on liquid to gas ratio and by optimizing the liquid to gas ratio its performance can be increased. Initially the (L/G) ratio was 3.25 (in case 1) and it is reduced to 2.60 (in case 2). As the (L/G) ratio is reduced the amount of air available for each water droplets increases and more amount of heat is transferred from the hot water to air. In case 3 and case 4 the effect of inlet water temperature is studied in both the cases the Outlet water temperature increases and effectiveness, range is reduced. So the water inlet temperature is an important factor in cooling tower design. Objectives of this experiment was to increase the effectiveness and mass flow rate of water and air were taken as the optimizing variables. In case 5 the both the mass flow rate of air and water are varied to improve its performance.

### VI CONCLUSION

The CFD analysis showed that by increasing the mass flow rate of air the performance of cooling tower can be improved. All the performance parameters such as cooling water range, effectiveness, tower characteristic ratio has increased. The increase in the effectiveness of cooling tower was about 20%. When the (L/G) ratio was reduced from 3.25 to 2.60. The outlet temperature of cooled water is reduced to 2 K. The effect of inlet water temperature on the performance of cooling tower was studied keeping other parameters such as mass flow rate, injection height, and fill area constant it was found that effectiveness is reduced by 8%. The effect of water mass...
flow rate was also studied and it was found that by optimizing the mass flow rate of both water and air the effectiveness can be increased. But reducing the mass flow rate of water reduces the output of the cooling tower and inlet water temperature depends on the plant operations.

REFERENCES


Workability, Compressive and Tensile Split Strength Behavior of Blue Gum Ash Glass Concrete

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Abstract- This research work investigated the plastic and hardened mechanical properties of concrete made using crushed glass as part of fine aggregates and blue gum ash dosed in the concrete. The blue gum ash cement was prepared by dosing Ordinary Portland cement (Power plus 42.5N) with blue gum ash at 0% (control), 0.5%, 0.75%, 1.0%, 1.25% and 1.5% by weight of cement and crushed glass used to partially replace river sand at 10% by weight of the fine aggregates for vibrated concrete, design mix of class 25. In order to achieve good workability, the best blue gum ash content was maintained at 1.0% and crushed glass content of 10%. For good compressive strength results of blue gum ash glass concrete, up to 10% crushed glass replacement in fine aggregates with 1.0% blue gum ash proportion in concrete attained the highest strength than the control (glass concrete only) achieving strengths of 27.8N/mm² and 30.1N/mm² at 7 days and 28 days respectively. The mathematical relationship between the compressive strength (Fcu28) at 28 days and the corresponding tensile split tensile strength (Ft28) at 28 days of blue gum ash glass concrete was found to be a binomial relationship of the Equation

$$F_{cu28} = 16.253F_{t28}^2 - 82.567F_{t28} + 136.68$$

Index Terms- Blue gum ash, crushed glass, workability, compressive strength, tensile split strength

I. INTRODUCTION

Concrete has unlimited opportunities for innovative applications, design and construction techniques. Its great versatility and relative economy in filling wide range of needs has made it is very competitive building material. Due to the increasing price, demand and consumption of cement, researchers and scientists are in search of developing alternatives to aggregates and binders, which are eco-friendly and contribute towards waste management. One of these alternatives to cement is blue gum ash (BGA). In previous studies, Rajabipour (2012) explains that concrete made through the replacement of river sand with glass aggregates demonstrated poor workability, which resulted in inefficient compaction and low strengths. Alkali Silica Reaction (ASR) was noted to be affecting most aggregate particle sizes. Ranagaraju and Afshinnia, (2015) showed that the finer the glass is crushed, the more the ability to resist ASR effect particularly when used as an aggregate replacement material, both in the case of crushed glass and natural reactive aggregates. From the manufacturer’s brochure of Power plus cement (42,5N), this CEM 1 type of cement has low alkali (Na₂O equivalent<0.6%) to guard against alkali aggregate reaction in concrete and that’s why it was used in the research.

Wood ash exhibits a specific gravity of 2.13 and bulk density of 810kg/m³, (Campbell & Etiegni, 1991). These properties depend on type and source of wood, design, boiler combustion temperature and collection technique. (Tarun and Rafat, 2014) reported the following elements in wood ash: carbon (5% to 30%), calcium (5% to 30%), carbon (7% to 33%), potassium (3% to 4%), magnesium (1% to 2%), phosphorus (0.3% to 1.4%), sodium (0.2% to 0.5%) and silica (4 to 59%). Samples stored in humid and dry environments, compressive and flexural strength were measured and the microstructure examined using SEM analysis (Tarun and Rafat, 2014). Methods for proper mixture proportioning to achieve desired strength and workability have not been established and the effects of glass, sand and blue gum ash on fresh and hardened properties of concrete are unknown. This project was aimed at bridging such knowledge gaps.

II. MATERIALS AND METHODS

1.1 Materials

Wood ash from blue gum was obtained from Tegat and Toror Tea Factories in Kericho county. Blue gum ash is a waste from boiler chimney, got from burning blue gum to produce steam in electricity generation process. Waste glass was obtained from Juja town, in Kenya. The other materials; Ordinary Portland cement (Power Plus 42.5N) satisfying BS12:1991 and KS-18-1:2000 of 28 days’ strength; 42.5N/mm² was used. River sand obtained from Machakos county and ballast obtained from Aristocrats Concrete Limited quarry in Mlolongo which control its ballast source due to consistency quality of its products in Kenya.
1.2 Methods

Wood ash from blue gum was obtained from Tegat and Toror Tea factories in Kericho county, was dried and sieved to ensure that only particles passing 0.075mm were collected for this study so as to conform with the maximum size of cement and eliminate the constituents of fine aggregates. Waste glass was obtained from Juja town, Kenya at selected collection points. Once the waste glass was obtained, it was crushed manually and reduced to 5mm grains and below as per BS882:1992. The type of glass which was used was clear float glass of 4mm thick which is visually colorless and distortion free glass, providing high light transmission (daylight) and clarity. The crushed glass was used as partial replacement material for river sand at 10% by weight.

The ballast consisted of crushed stone mixed in a ratio of 1:2 for 10mm and 20mm single aggregate size in accordance with building research establishment BRE (1988).

The results of the specific gravity of river sand and crushed glass were found to be 2.5 and 2.4 respectively. The specific gravity of sand was found to be within the range of 2.63 and 2.70 as per BS1097-6 (2013); hence adequate. Also, the specific gravity of sand provided by Firm.net (2017) are a minimum of 2.4 and a maximum of 2.8 thus the test result was found to be credible for use in this research. The bulk density results for ballast, river sand and crushed glass were 1405kg/m³, 1563kg/m³ and 1414kg/m³ respectively. According to BS 812-2 (1990), the approximate bulk density of aggregates commonly used in normal-weight concrete ranges from about 1200 to 1750 kg/m³. The result for the bulk density of blue gum ash was found to be 798kg/m³, while the bulk density of Ordinary Portland cement (Power plus 42.5N) has been found to range between 800 – 1000kg/m³ so it was approximately within the range hence suitable admixture material.

The silt content results of river sand and crushed glass were found to be 2.24% and 5.58% respectively. It is recommended to wash the sand or reject if the silt content exceeds 6% (BS 812: Part 1: 1975), hence the results were satisfactory within the limit required.

Sieve analysis of river sand, crushed glass and ballast were done according BS812 (1985) and all the aggregates fell within the grading envelope indicating that they were within the acceptable limits.

For comparison between grading for river sand and crushed glass, Figure 1 below was used to show the similarities between the two materials for the research work.

From Figure 1 above, crushed glass and river sand grading curves were behaving in a similar manner for their individual particle size distribution. River sand was found to have more particles passing through 600μm than crushed glass. Also, the material passing sieve 150μm was more in glass at 12% compared to sand at 8%. This explained the difference in curve formation between the two materials for fine aggregates but generally the materials were suitable for use in the research. The grading curve for the coarse aggregates is as shown in Figure 2 below.

From the aggregate curves in Figure 2 for coarse aggregates, most of the aggregates were found to lie within zone two and were within the required limits as given in BS812:103-1. (1985), hence they were recommended for use in the research work. In determination of the workability and compressive strength effects of blue gum ash glass concrete, concrete mix of the ratio 1:1.5:3 was used where the batching was done by weight. The blue gum ash cement was prepared by dosing Ordinary Portland cement (Power plus 42.5N) with blue gum ash at 0%(control), 0.5%, 0.75%, 1.0%, 1.25% and 1.5% by weight of cement and crushed glass used to partially replace river sand at 10% by weight of the fine aggregates.
The slump test was performed according to BS EN: 12350: 2009 whereby the standard slump cone was filled with concrete in four layers, rodding 25 times per layer, then lifting the cone and measuring the extend to which the concrete collapsed. The concrete collapse (slump) was maintained between 10 – 25 mm as required for vibrated concrete. This was done for each blue gum dosage of 0% (control), 0.5%, 0.75%, 1.0%, 1.25% and 1.5% for cement in glass concrete production.

Compressive strength test was done to determine the strength of the hardened glass concrete containing blue gum ash. It was done in accordance to BS EN: 12390: 2000, whereby samples containing different dosages of blue gum ash were casted in moulds of internal dimensions of 150x150x150mm. Then the compressive strengths at 7, 14, 21, 28 and 90 days were determined by crushing the samples in a universal testing machine as shown in Figure 3(a) below. For each proportion, three cubes were casted and the average taken.

From Table 1 above, the slump level increased with increase in blue gum ash content but according to the consistency test, the best working value was maintained at 1% blue gum dosage. According to concrete specifications, vibrated concrete slump should be between 30mm- 60mm and most of the values were within the acceptable range as shown in Figure 4 below. For medium workability of concrete, the allowed slump is between 50-100mm hence blue gum ash proportions of between, 1.0% to 1.5% satisfied the requirements.

The compaction factor was seen to behave the same way as the slump, i.e. increased with increase in blue gum ash proportion up to 0.93 for 1.0% blue gum ash proportion then started decreasing. For medium workability of concrete, the allowed slump is between 50-100 mm (https://www.aboutcivil.org/concrete-slump-test.html); hence blue gum ash proportions of between, 1.0% to 1.5% satisfied the requirements. For the compaction factor, all mixes were within 0.9 ranges hence the addition of blue gum ash improved the compaction factor of class 25 concrete. The variation graphically for the compaction factor is as shown by Figure 5 below.

According to M. T. Atoom (2002), the normal range of concrete the compaction factor lies between (0.8 – 0.92). From the results

**III. RESULTS AND DISCUSSION**

In Table 1 below, 25GCBGA XX-YY means: 25 is the class of concrete 25N/mm², GCBGA is glass concrete containing blue gum ash, XX means percentage of glass in fine aggregate and YY means percentage dosage of blue gum ash by weight of cement. These descriptions of concrete were used throughout the study of the behavior of blue gum ash glass concrete. Table 1 below shows the resulting water cement content, slump obtained and the compaction factor.

**Table 1: Water cement ratio, slump and compaction factor**

<table>
<thead>
<tr>
<th>Mix type</th>
<th>Slump (mm)</th>
<th>Water-cement ratio</th>
<th>Compaction factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>25GCBGA 10-00</td>
<td>35</td>
<td>0.555</td>
<td>75.73</td>
</tr>
<tr>
<td>25GCBGA 10-0.5</td>
<td>41</td>
<td>0.552</td>
<td>63.43</td>
</tr>
<tr>
<td>25GCBGA 10-0.75</td>
<td>44</td>
<td>0.550</td>
<td>79.93</td>
</tr>
<tr>
<td>25GCBGA 10-1</td>
<td>47</td>
<td>0.549</td>
<td>117.49</td>
</tr>
<tr>
<td>25GCBGA 10-1.25</td>
<td>53</td>
<td>0.548</td>
<td>98.60</td>
</tr>
<tr>
<td>25GCBGA 10-1.5</td>
<td>62</td>
<td>0.546</td>
<td>91.52</td>
</tr>
</tbody>
</table>

**Figure 3: Crushed cube after testing**

**Figure 4: Slump variations**

**Figure 5: Compaction factor variations of blue gum ash glass concrete**

According to M. T. Atoom (2002), the normal range of concrete the compaction factor lies between (0.8 – 0.92). From the results
shown above, blue gum ash replacement of up to 1% dosage of cement by weight, containing crushed glass content of 10% by weight of fine aggregate satisfies the normal range of concrete compaction factor of (0.8-0.92).

Table 2 below shows the 7, 14, 21, 28 and 90 days compressive strengths of each mix proportion and each value is the mean of triplicate results per test.

Table 2: Compressive strength of glass concrete with blue gum ash cement

<table>
<thead>
<tr>
<th>Mix type</th>
<th>7 day strength (N/mm²)</th>
<th>14 day strength (N/mm²)</th>
<th>28 day strength (N/mm²)</th>
<th>60 day strength (N/mm²)</th>
<th>90 day strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25GCBGA 10-0.0</td>
<td>25.31</td>
<td>28.62</td>
<td>31.21</td>
<td>35.19</td>
<td>38.48</td>
</tr>
<tr>
<td>25GCBGA 10-0.5</td>
<td>24.56</td>
<td>28.19</td>
<td>30.14</td>
<td>34.23</td>
<td>37.74</td>
</tr>
<tr>
<td>25GCBGA 10-0.75</td>
<td>22.48</td>
<td>27.56</td>
<td>29.19</td>
<td>32.05</td>
<td>35.42</td>
</tr>
<tr>
<td>25GCBGA 10-1.0</td>
<td>27.81</td>
<td>30.13</td>
<td>32.84</td>
<td>35.27</td>
<td>39.35</td>
</tr>
<tr>
<td>25GCBGA 10-1.25</td>
<td>26.16</td>
<td>28.48</td>
<td>32.14</td>
<td>34.88</td>
<td>38.93</td>
</tr>
<tr>
<td>25GCBGA 10-1.5</td>
<td>25.14</td>
<td>28.10</td>
<td>31.83</td>
<td>34.19</td>
<td>37.36</td>
</tr>
</tbody>
</table>

Comparatively, the strength of the glass concrete made using blue gum ash at 1.0% was found to have highest strength than the control experiment. Also, the strengths were found to decrease from 0.5% to 0.75%, increase from 0.75% to 1.0% then continuously decrease up to 1.5% blue gum ash proportion. This explains that, up to 10% crushed glass replacement in fine aggregates with 1.0% blue gum ash proportion in concrete attained the highest strength. From the different mixes containing blue gum ash, 1% dosage of cement by blue gum ash gave the highest strength and 0.75% gave the lowest strength at all ages of concrete as shown in Figure 6 below:

Figure 6: Compressive strength of glass concrete with blue gum ash

As the level of blue gum dosage increases, the early-age strength decreases. However, long-term strength development is improved when blue gum ash is used and at some age, the strength of the ash concrete becomes equal to that of the pozzolanic cement. The age at which strength parity with the control (pozzolanic cement) concrete is achieved is greater at higher levels of blue gum ash. The ultimate strength achieved by the concrete increases with increasing blue gum ash content, at least with dosage levels up to 1%. Generally, the differences in the early-age strength of pozzolanic cement and blue gum ash concrete are less for blue gum ash with higher levels of calcium. Notably also was the increase in strength with increase in concrete age up to 90 days. This is because concrete containing pozzolanic cement gains strength with age for the rest of its life. Table 3 below shows the results of the 7 days and 28 days tensile split strength of blue gum ash glass concrete, each value being a mean of three-cylinder test results.

Table 3: Tensile split strength of glass concrete with blue gum ash cement

<table>
<thead>
<tr>
<th>Mix type</th>
<th>7 Day strength (N/mm²)</th>
<th>28 Day strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25GCBGA 10-0.0</td>
<td>2.00</td>
<td>2.65</td>
</tr>
<tr>
<td>25GCBGA 10-0.5</td>
<td>1.89</td>
<td>2.16</td>
</tr>
<tr>
<td>25GCBGA 10-0.75</td>
<td>2.03</td>
<td>2.66</td>
</tr>
<tr>
<td>25GCBGA 10-1.0</td>
<td>2.18</td>
<td>3.00</td>
</tr>
<tr>
<td>25GCBGA 10-1.25</td>
<td>1.98</td>
<td>2.72</td>
</tr>
<tr>
<td>25GCBGA 10-1.5</td>
<td>1.57</td>
<td>2.56</td>
</tr>
</tbody>
</table>

The results in Table 3 showed that the tensile split test increased with increase in the concrete curing age, and also increased with increase in blue gum ash content in the mix up to 1% by cement weight attaining strengths of 2.18 N/mm² and 3.0 N/mm² for 7 and 28 days respectively then the strengths started decreasing. Also notable is that these strengths were higher than the control (glass concrete only) as shown in Figure 7 below.

Figure 7: Tensile split strength of glass concrete with blue gum ash

Concrete is poor in tension and good in compression, hence the low tensile split strength values. Pozzolanic materials gain strength with age, hence as the curing age increases, the strength increases. The increase in blue gum ash, increased bonding between the concrete matrix, hence as the level increases, the strength increases up to the optimum level where by, increase in
the blue gum ash content does not have the bonding effect, hence the decline in strength.

Table 4: Compressive strength against tensile split strength of glass concrete with blue gum ash cement

<table>
<thead>
<tr>
<th>Mix type</th>
<th>28 Day compressive strength (N/mm²)</th>
<th>28 Day tensile split strength (N/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25GCBGA 10-0.0</td>
<td>35.19</td>
<td>2.65</td>
</tr>
<tr>
<td>25GCBGA 10-0.5</td>
<td>34.23</td>
<td>2.16</td>
</tr>
<tr>
<td>25GCBGA 10-0.75</td>
<td>32.05</td>
<td>2.66</td>
</tr>
<tr>
<td>25GCBGA 10-1.0</td>
<td>35.27</td>
<td>3.00</td>
</tr>
<tr>
<td>25GCBGA 10-1.25</td>
<td>34.88</td>
<td>2.72</td>
</tr>
<tr>
<td>25GCBGA 10-1.5</td>
<td>34.19</td>
<td>2.56</td>
</tr>
</tbody>
</table>

Figure 8 was used to explain the relationship based on the strengths at 28 days. The mathematical relationship between the compressive strength (F_{c28}) at 28 days and the corresponding split tensile strength (F_{t28}) at 28 days is represented in quadratic Equation 1.

\[ F_{c28} = 16.253 F_{t28}^2 - 82.567 F_{t28} + 136.68 \]

IV. CONCLUSIONS

From the results and discussions above, it was concluded that:

i) Blue gum ash (BGA) is hydrophilic, hence the higher the amount in concrete, the less the amount of water required for good workability to be achieved.

ii) From the results, in order to achieve good workability, the best blue gum ash content can be maintained at 1.0% and crushed glass content of 10%.

iii) For good compressive strength results of blue gum ash glass concrete, up to 10% crushed glass replacement in fine aggregates with 1.0% blue gum ash proportion in concrete attained the highest strength than the control (glass concrete only).

iv) The mathematical relationship between the compressive strength (F_{c28}) at 28 days and the corresponding tensile split tensile strength (F_{t28}) at 28 days of blue gum ash glass concrete is represented by quadratic Equation

V. RECOMMENDATIONS

From the experimental results and analysis, the following recommendations were made:

a) In order to recycle and make our wastes useful especially in civil engineering, there is need to encourage researchers to take up research courses on these wastes to determine their engineering properties and where they can be used best. E.g. Recycled waste use in Civil Engineering.

b) Once cement is dosed with blue gum ash at 1% and fine aggregates replaced with crushed glass at 10%, good workability is achieved and early strength developments of up to 35.27N/mm² in 28 days. This mix can be used for lightly loaded beams like lintels and slabs in buildings.

c) There is also need to develop codes or guiding standards on the use of various wastes like blue gum ash and glass in concrete. Once developed, there will be reduced cost of construction due to use of readily available wastes and solve the problem of environmental degradation.
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Aadhar Based Airport/Passport Entry System

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Abstract - Now days in our country the security is not up to the mark in the airports. The reason behind this that easily availability of the fake passports. To overcome that Aadhar based seeding Passport system should be implemented, i.e, Aadhar card number of the individual has to be linked with the Passport and retina, finger prints should be matched when the boarding pass is provided to the concern individual to enter for the boarding.

Index Terms - Retina Scanning, Fingerprint Scanner, foot Print Scanner, Unique Identification Number

I. INTRODUCTION

The most important thing in day todays life is security for all the cases. One of the most important security things to be provided in the airports, passports and air tickets. All the passports consisting of individuals should be linked with unique identification number like aadhar. Even for booking the air ticket for domestic flights also unique identification number has to be linked. Once the UID number is linked with all the above cases, then when the individual entered into the airport before getting the boarding passes, the air ticket, passport has to be checked with three relevant conditions.

1. Retina Scanning,
2. Fingerprint Scanning,
3. Footprint Scanning.

In these three scanning conditions atleast two scanning reports has to be shown matched with the individual, then the concern person is allowed to enter into the boarding station to flight, otherwise the person will not be allowed in to the boarding station and he will be transferred to Airport authorities for further enquiries.

II. IDENTIFY, RESEARCH AND COLLECT IDEA, EXISTING METHOD

In the Existing method of the passport and air ticket travelling the following steps are being followed

1) Security Check Entering
2) Boarding Pass/Check-in
3) Luggage Testing and verification
4) Waiting for announcement
5) Pre Boarding announcement
6) Final Boarding Announcement
7) Flight takes off

In the analysis of all these systems the security they are been provided is functioning, but, it has to be more improved.

III. WRITE DOWN YOUR STUDIES AND FINDINGS, PROPOSED METHOD

To overcome the current scenario, it has been proposed to implement the new set of security functions like seeding the aadhar number to the passport and also for the air tickets for the domestic flights.
Once the passport is linked with the aadhar number then, all the information stored in the aadhar will be transferred both in passport and aadhar. Once the passport no and aadhar no matched with all the information then, the scanned document of the retina, fingerprint and foot prints will be stored in the passport no of the individual and then, the verification becomes easier when the individual goes for the boarding pass.
IV. UNIQUE IDENTIFICATION ID

People who travel from other countries to India may not have an Aadhar card for the verification purpose. So, they will be provided with the unique identification ID where it will used until the completion of the visa.

V. BLOCK DIAGRAM

![Block Diagram]

Figure 4. Proposed Transmission Process of the Aadhar based passport entry system

VI. CONCLUSION

To overcome the current scenario, the Aadhar based passport linking system would eradicate the fake passports and also implement the high security with this process.

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Challenges Encountered By Scholars in Sub-Saharan Africa: A Case of Kenyan Universities

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Abstract- Some universities in Africa are almost non-existent in the international ratings in terms of research. Why? This paper attempted to investigate some of the challenges encountered by scholars in some selected Kenyan Universities as a representative of other universities in Sub-Saharan Africa. The study used a descriptive survey design. Structured and unstructured questionnaires were used to collect data from university academic staff drawn from 3 public universities and 2 private universities. A combination of stratified and purposive sampling methods were used to select respondents. Respondents were categorized in terms of their academic ranks and sex. Random sampling was used to select the respondents proportionately from each category. The data collected was analyzed using descriptive statistics followed by discussions. It was found that financial constraints, poor university management and ethnicity are among the challenges that hinder research in Kenyan universities. The study gave various recommendations including the allocation of sufficient funds to research related activities.

Index Terms- Challenges, Universities, Sub-Saharan Africa, Kenya, Research

I. INTRODUCTION

World over, the core functions of universities centre around four areas; teaching, research, publishing and community outreach. The academic staffs are expected to be scholars who produce knowledge mainly through research. (NCHE, 2011). Research comprises of creative work undertaken in a systematic basis in order to increase the stock of knowledge; including knowledge of people, cultures and societies, and the use of this stock of knowledge to devise new applications (Mugenda & Mugenda, 1999). Academic research is a pathway to socio-economic, cultural and political transformations in the African Continent. Research is therefore a prerequisite for the success and credibility of any academic institution around the world. Africa not being an exception. The major centres of research, knowledge creation and scholarly communication in Africa are universities (Teferra, 2004). However, most universities in Sub-Saharan Africa have many problems that constrain their research output.

There is evidence that universities in Africa contribute less than 1 percent in international referred Journals. The contribution of African universities to World’s scientific publications is only 1.4 percent with more than half of these coming from Egypt and South Africa’ (Hassan 2008). Yet, for a university to be relevant, its academic intellectuals must engage in quality teaching and researches that reflect the scientific and technological needs of society. This is an obvious threat to the growth of Africa’s economies. It is paramount that the university academic staff should be constantly engaged in research-related activities apart from teaching. Currently however, this does not always happen. Some universities in Africa are almost non-existent in the national and international ratings in terms of research.

Kenya in particular has 33 chartered public universities and almost 20 chartered private universities and 13 other universities with Letter of Interim Authority (LIA). These universities are established through institutional Acts of Parliament under the Universities Act, 2012 which provides for the development of university education, the establishment, accreditation and governance of universities. Recent university rankings generally show that Kenyan universities are performing poorly. Other than other factors like teacher-student ratio, ranking takes into account the universities' research outputs and general contribution to new knowledge; levels of training and application of science and technology; presence on the internet and use of Information and Communication Technologies; volume of published material on the web; visibility and impact of the universities' web pages as measured by the citations (site visits) or links they receive (in links). The above issues present a worrying situation for Kenyan universities considering that Kenya is still a developing African country. The UN Development Index ranks Kenya as the second most ‘unequal’ country in East Africa, after Rwanda (Hassan, 2001). Ostensibly, there are fears that this inequality is as a result of lack of research to help alleviate problems. How has the government responded to this dilemma in the wake of decreasing financing in public Universities? What should be done to recreate a research University in Africa with academic staff capable of carrying out productive research? Using open questionnaires and documentary evidence from published works, we conducted a study on the challenges university scholars in Kenyan Universities are facing in conducting research-related activities and the necessary interventions that would recreate the research University for better academic service delivery and development.

II. THEORETICAL ORIENTATION

The study was guided by Vroom's Expectancy Motivation Theory (Vroom, 1999). The theory separates effort (which arises from motivation), performance, and outcomes. The theory
assumes that behavior results from conscious choices among alternatives whose purpose is to maximize pleasure and to minimize pain. Vroom realized that an employee's performance is based on individual factors such as personality, skills, knowledge, experience and abilities. He stated that effort, performance and motivation are linked in a person's motivation. **Expectancy** is the belief that increased effort will lead to increased performance. This means that if university scholars work harder, then the returns from research activities both at individual, university and country will be better. This is affected by such things as:

i. Having the right resources available such as time and resources
ii. Having the right skills to do the job
iii. Having the necessary support to get the job done such as supervisor support, or correct information on the job

The element of expectancy is important behind the motivation behind research activities at the University and the possible obstacles towards achieving the same. Thus, Vroom's expectancy theory of motivation is not about self-interest in rewards but about the associations people make towards expected outcomes and the contribution they feel they can make towards those outcomes.

### III. MATERIALS AND METHODS

The study adopted a descriptive and an explanatory research design. This involved the use of open ended and closed ended questionnaires to collect, analyse, and interpret data. The study was conducted in three public universities and two private universities in Kenya among the academic staff. Academic staff comprised of the ranks of full professor, associate professor, senior lecturer, lecturer and tutorial fellow (both men and women). The public universities included; Masinde Muliro University of Science and Technology (MMUST), Kibabii University (KIBU) and Maseno University (MU). Private universities on the other hand comprised of Mt. Kenya University (MKU) and Catholic University of Eastern Africa (CUEA)-Nairobi. The selection of the mentioned universities was based on the convenience to the researcher and the possibility to access relevant data in the institutions. Data was collected between March and June 2017.

The universities were selected using stratified random sampling procedure. They were stratified into public and private. From each stratum, three public universities and two private universities were selected purposively. Stratified random sampling was used because the population studied was heterogeneous in terms of gender, rank and category of the university. A total of 300 questionnaires were administered in the ratio of 80 to 20 for male and female academic staff respectively. Out of the 300 questionnaires, only 220 were returned for analysis as shown in figure 1 and 2 respectively.

![Fig 1: Distribution of respondents by University, category and sex](source: Author 2017)

Figure 1 shows that data was collected from three public and two private universities. The respondents included 150 male respondents and 70 female respondents. Figure 2 represents the distribution of the respondents in terms of rank and sex.
Figure 2: Distribution of respondents by rank and sex

Source: Author 2017

Figure 2 indicates that data was collected from five positions of the university teaching staff (male and female) namely; Full professor, associate professor, senior lecturer, lecturer and tutorial fellow.

The information obtained from questionnaires was analyzed through content analysis and categorized into themes: economic challenges, socio-cultural challenges and political challenges. Descriptive statistics, such as frequency tables and percentages were used to show the status of the challenges. Documentary data from available researches was also utilized to cross check, supplement and confirm information obtained from questionnaires.

IV. RESULTS AND DISCUSSION

Figure 3 displays the total frequency distribution of the economic, socio-cultural and political challenges in relation to research-related activities in Kenyan universities.

Figure 3: Economic, socio-cultural and political challenges

Source: Author 2017

The study findings reveal that 140 (63.63%), 60 (27.27%) and 20 (9.09%) respectively of the respondents reported that there were economic challenges, socio-cultural challenges and political challenges facing researchers in Kenyan universities.
4.1 Economic related challenges

From the questionnaire responses, the majority of the challenges (63.63%) facing university scholars in Kenyan Universities emanate from economic factors summarized in table 5 below:

**Figure 4: Economic challenges**

![Economic challenges](image)

*Source: Author 2017*

From figure 4, above, financial constraints 60 (42.85%), limited amount of time for research 50 (35.71%) and inadequate resources to conduct research 30 (21.42%) are some of the economic challenges that respondents mentioned.

4.1.1 Financial constraints

According to the respondents, financial constraint was a major challenge (42.85%) among university scholars. Most projects in public universities rely on donor funding since most universities are financially constrained in their budgetary allocations to carry out research activities. Although Kenyan universities make yearly budgetary allocations for research, it was evident that these allocations are inadequate to carry out all important research-related activities.

It is therefore, evident that many scholars in Kenyan Universities work in institutions which are not well financially endowed due to insufficient funding that lead to lack of incentives, non-attendance of academic conferences and limited salaries and remunerations. In such institutions, research facilities are inadequate and outdated by international standards. The main causes for this include pressures of massification that require expansion of universities to cater for the large increase in student numbers; economic problems faced by the country arising out of insecurity, elections, foreign debts and the decline of some sectors in the economy; inability of students to afford the tuition required for financial stability and misallocation and poor use of available financial resources by some of the universities.

4.1.1.1 Inadequate funding

Government funding to public universities in Kenya has been dwindling gradually over the years, hence forcing the universities to reduce funding for some of the projects including research (Hassan, 2001). Research funding is almost non-existent in private universities in Kenya. Enrolments grew much faster than state funding to universities, upon which they greatly depend. The Economic Survey, 2014 showed that subsidies to public universities grew by 6% during the period to reach US$ 624 million, from US$588 millionin2012. This means that enrolments in public universities rose seven times faster than funding, pushing universities into income generating activities to meet the costs of extra students at the expense of funding research activities. Mamdani (2007: 17) notes that:

"Funding higher education has emerged as one of the biggest concerns in Kenya, with the surge in student numbers. Government subsidies are no longer enough and universities are going into commercial activities."

The lack of fund has necessitated universities to employ under qualified staff who cannot undertake the mandate of research adequately. The Universities Academic Staff Union (UASU) data indicates that there are 8,000 lecturers - up from 7,000 four years ago. However, during the same period, student enrolment has grown from 91,541 to 140,000. Education experts and university administrators have argued that rising enrolment can only be handled if the government pumps in more funds to hire extra tutors and improve pay for the teaching force, to boost their morale. The issue of funding has been at the centre of a series of other problems like lecturer’s strikes, inadequate remuneration in form of salaries and incentives and workload...
among the universities. This has resulted into several unfortunate consequences particularly low morale and self-esteem, resignation to join better paying institutions, low productivity and poor outputs especially in research and innovations. Limited university funding is a mother of almost all the other challenges that affect research in Kenyan universities.

4.1.1.2 Lack of Incentives
Scholars publish for several reasons among them, good incentives which can persuade them to conduct research-related activities. Institutions of higher learning in Kenya, which are the major employers of scholars in the region, hardly ever give any incentives to scholars who publish their findings in scholarly journals. Some respondents admitted that the policy for incentives was in place but due to financial constraints, the policy has not been implemented. Apart from some subsidy for publishing, there are other incentives which can create an enabling environment for scholarly publishing. For example, maintaining the best infrastructure that institutions of higher learning should have and maintaining the prestige and comfort associated with higher education. It was reported among some respondents that some of them operate from their houses or cars due to lack of working space at their respective universities.

4.1.1.3 Non-attendance of Academic Conferences
Numerous academic conferences are organized around the globe every year. Attending such conferences is crucial for scholars working for institutions of higher learning and other research institutions in Sub-Saharan Africa. Some of the conferences are organized locally or within the region, but many scholars from Kenyan universities cannot attend because their employers cannot afford to sponsor them. In conferences, scholars have an opportunity to present their research findings for peer critique, especially by counterparts from other regions of the world. Such research findings may finally be published either as conference proceedings or as articles in scholarly journals. Scholars in Kenyan universities find it too costly to sponsor themselves. Even conferences organized locally are out of reach for most of them. This is another demotivating factor among scholars to research and publish.

4.1.1.4 Salaries and Remuneration
Academic intellectuals are the most highly trained human resource in society and yet they are poorly paid or rewarded both in monetary and non-monetary terms. The poor salary and remuneration has a negative impact on the lecturer’s role as a researcher either directly or indirectly (Hassan, 2001). This is one of the main reasons why there is a high turnover of academic staff and part-time teaching in African institutions of higher learning. In the last three decades, African universities have been characterized by high tensions between academic staff and the administration and/or government. In several instances, academic staff have withdrawn their labour due to inadequate remuneration and lack of scholarly materials and other resources that can enable them to teach, conduct research and perform community work.

Kenyan lecturers are the lowest paid compared to other political positions like being a Member of the County Assembly (MCA). For this reason, Individuals who could have filled the existing gaps in personnel in Kenyan universities are going into better paying jobs in the corporate world or crossing over into politics where they are sure of better salary and remuneration. The commission in charge of salary regulation and remuneration, commonly referred to as the Sara Serem Commission has been taken to court by UASU. The main grievance is the adjustment of the low salaries that the Commission has stipulated in its structure for the University dons compared to other professionals in other sectors. The Commission is blind to the existing challenges faced by a university don in Kenya. Low pay is being blamed for brain drain of lecturers from Kenyan universities, not only to Europe and North America but also to other African countries such as South Africa, Botswana, Uganda, Tanzania and Rwanda, where tutors are paid better and handle lower numbers of students per class. In Tanzania, the average monthly salary of a lecturer is around US$3,000.

Kenya is facing fresh threats of a Lecturers' strike over delayed implementation of new salaries and allowances for the 2013-2017 Collective Bargaining Agreement (CBA) which could jeopardise research activities in public universities from October 2017. Close to 9,000 lecturers from Kenya's 33 public universities and colleges have said that they would down tools if the government fails to implement the 2013-17 CBA fully. The situation was reported to be worse among lecturers from private universities who don’t have a union to represent their grievances to management or the government.

4.1.2 Amount of Time Required for Research
The second major economic challenge that was reported by 50 (35.71%) of the respondents was the limited time that lecturers have to conduct research. According to some respondents, research takes a longer time and it requires a lot of commitment. It was reported that most teaching staff are busy with routine teaching tasks, marking and part-time teaching hence they do not have adequate time for research. The work overload is due to the shortage of staff and the enormous student enrolment.

4.1.2.1 Workload
Parallel programmes, commonly referred to as module 11 have been a boom for universities in Kenya by increasing funding and access to university education. However, this has happened at the expense of the time a lecturer requires for research and professional development. The situation has deteriorated to a point where the balance between productivity gains and the quality of teaching is under threat. The student-to-lecturer ratio in the universities has deteriorated from 25:1 in 1986 to 52:1 in 2013. Currently, the average lecturer to student ratio stands at 1:500. In some instances, the ratio can go up to 1:1000 students. The United Nations Educational, Scientific and Cultural agency (UNESCO) recommends a ratio of 1:45.

The latest government data shows that public and private universities in the country combined enrolled 506,083 students in 2015. This compares to 2014's 443,783 students and the enrolment was more than double the enrolment in 2013. A 2010 survey by Kenya's Commission for Higher Education showed the country's 30 universities were being crippled by an acute shortage of professors, with institutions increasingly turning to part-time lecturers to address the shortfall. The higher education
commission said there were only 352 professors in Kenya's universities, (CUE, 2016).

University Academic Staff Union (UASU) national officials have repeatedly warned that the student expansion plan would only be possible if more staff is hired and physical infrastructure are expanded. Otherwise, it would only mean more work for lecturers at the expense of research (Daily Nation News, 2016).

4.1.2.2 Part-time Teaching

The number of universities has increased after the government upgrading many university colleges into full-fledged institutions. Contrary to this upgrading, the requisite infrastructure and human resource has never been provided, resulting in undue pressure on the existing facilities and personnel. According to a recent study carried out by the Kenya Institute of Public Policy and Research (Kippra), up to 50% staff at public universities do part-time jobs, mostly teaching in other universities and spending their days criss-crossing from one university hall to another, oblivious of the effect such moves have on their time for research. The lecturers shuttling from one campus to another are simply filling a gap in service provision and supplementing their meager income.

With these pressures, the lecturer’s output in research is obviously affected. The lecturer gets home tired and has to mark exams or set new ones or prepare for the numerous lectures. All major Kenyan universities have also satellite campuses throughout the country that continue to get fresh enrolments on a daily basis, further tipping the already overloaded lecturer.

4.1.3 Inadequate Resources

From table 4.0, it was revealed that 30 (21.42%) of the respondents are unable to conduct research due to insufficient resources at their disposal. It is quite clear that resources play a key role in conducting research-related activities at any institution of higher learning. The respondents cited resources like computers, network and internet connectivity, science laboratories, and libraries as inadequate in most universities. These facilities are meant to support lecturers who want to access materials for research. These facilities are very crucial for any successful scholarly research in the 21st Century. The lack of these facilities has also contributed to the lack of empirical rigour due to lack of resources; limited collaborations between practitioners and academics; limited linkage between research and the national development agenda.

4.1.3.1 Library

A well-stocked modern library is an important tool for scholarly research and publishing. In the industrialized nations, a network of libraries account for up to 80% of the total purchases of scholarly books (Altbach, 1978). In sub-Saharan Africa, Kenya in particular, there are no well-organized networks of libraries which may jointly purchase scholarly books. Altch (1978) notes that even academicians, which feature near the top of the income ladder, have difficulty in purchasing scholarly books and journals. Due to poor funding and continuous budget cuts, the libraries in Kenyan universities cannot afford to subscribe to journals. New book titles are published every year. However, such books are too costly for libraries. Book shelves of most academic libraries in sub-Saharan Africa are dotted with very old and insufficient copies of books which cannot help scholars from such universities to make any meaningful scientific and scholarly progress. Inadequately equipped libraries exacerbate the limited research activities among scholars with limited access to modern journals and the internet. University presses are under-funded or non-existent, and university journals are either few or unavailable.

The training of library personnel to gain knowledge of the new technologies used in modern libraries has been another casualty in the process. A recent World Bank report makes this point strongly by admitting that: “Sub-Saharan Africa is at the bottom of almost every knowledge economy indicator”. For instance, it contributes 0.07 per cent of global patents applications, an indication of the continent's technological leadership. The region has the lowest researcher-to-population ratio in the world with less than 100 researchers per million inhabitants compared to about 700 in North Africa. This observation signals a long way to go to create the foundation for high-quality research, graduate education, and knowledge creation in our universities.

4.1.3.2 Laboratories

Scientists depend on laboratories to conduct experiments from which they get results which they publish as findings in scholarly journals. However, laboratories in institutions of higher education and other research institutions in Kenyan universities lack up-to-date facilities for conducting such research. Laboratories are also subjected to budget cuts every year. Lack of well-equipped laboratories can contribute to regression of scholarly research and publishing in science disciplines. In a study conducted by Waast (2002), it is reported that some countries in sub-Saharan Africa, such as Nigeria, have regressed in many fields of science. In other countries in sub-Saharan Africa, whole areas of expertise have virtually disappeared, such as agricultural sciences in Kenya and Côte d’Ivoire. Scholars from two Kenyan universities indicated that there were completely no Science laboratories in their institutions.

Information, Communication and Technology (ICT)

Universities in Kenya lack affordable and adequate Internet bandwidth that hinders lecturers from conducting research. Some of the respondents indicated that there was limited internet connectivity in their respective universities. Either the Internet connectivity is too costly for the institutions to maintain, or electric power supply is poor and unreliable. Very few institutions of higher learning in the sub-Saharan region enable scholars to have free and unlimited access to the Internet (Hassan, 2001).

The cost of bandwidth in most universities is high despite the introduction of bandwidth subsidy by the government through the Kenya Education Network (KENET) and the arrival and operationalization of the undersea backbone fibre optic cables in Kenya in the year 2012. For this reason, currently universities cannot afford to procure adequate internet bandwidths. According to the E-Readiness Survey of Kenyan Universities (2013) report, the current price of $160 per Mb/s
was still a high price in comparison to developed countries. Some scholars in Kenyan universities do not have access to personal computers, e-mail and the Internet, and may not be able to submit their manuscripts, nor read them or act as peer reviewers electronically. This may mean that scholars from sub-Saharan Africa who are highly qualified and capable of making contributions to knowledge production are excluded because of technology deprivation. Arunachalam (2003) thinks that the ICTs, rather than bridging the digital divide, will widen the knowledge divide or the disparities in people’s capacities to do research and their ability to use the technologies to their advantage.

The study further revealed that lack of relevant training in ICT skills among teaching staff was a challenge hindering them from conducting research. Though some of the teaching staff have basic computer literacy skills, these skills may not be adequate for them to use ICT in research. Wanyembi (as cited by Tarus, 2011: 138) found out in a survey done in Kenya that most of the academics in universities have low ICT and e-learning skills because most of them were trained in the absence of ICT environment. Information, Communication and Technology skills for lecturers are critical components necessary for successful research. A number of journals are now electronically available. Such journals accept manuscripts electronically as well as get the manuscripts peer-reviewed electronically.

4.2 Social Cultural-Related Challenges

Socio-cultural challenges are the second prominent 60 (27.27%) challenges that are affecting university scholars as indicated in figure 5 below:

4.2.1 Language Barrier

According to 2 (3.33%) of the respondents, language is a barrier. Scholars are expected to communicate in foreign languages that most of them did not grow up speaking. Some scholars from learn to speak foreign languages at the university and therefore, they never get to master the languages in which they have to publish yet language is the vehicle for scholarly communication. (Jaygbay, 1998). In sub-Saharan Africa, the official languages for scholarly communication are English, French and Portuguese, all of which are foreign and therefore, not thoroughly mastered by majority of the scholars in the region. Language of scholarly communication may not look like a major problem, but Jaygbay thinks it excludes half of the African population from participating in most official public discussions. For example, English is generally considered to be the lingua franca of the scientific community. Roughly 80% of all the journals indexed in Scopus are published in English. The adoption of English as the universal language of science is due in part to historical political and economic factors which favored English over other potential languages such.

Considerations such as grammar may lead to the rejection of manuscripts from Sub-Saharan Africa (Pearce, 2003). The rejection of the manuscript is likely to demotivate the researcher in carrying out further researches. As long as scholarly communication will be in foreign languages, scholars from Sub-Saharan Africa will be disadvantaged and majority of their works will not be published in prestigious scholarly journals. Kiswahili is a widely spoken language in East, Central and some parts of southern Africa. However, even scholarly works on Kiswahili are published in foreign languages. Afrikaans was widely spoken in South Africa, but from 1994 when the country held its first multi-party elections, the language has been fizzling out. Up to this day, some scholars in South Africa and Namibia publish in Afrikaans, but only in journals based in South Africa.

4.2.2 Lack of Mentorship and Training of Emerging Researchers
According to 10 (16.66%) of the respondents, it emerged that most senior scholars like full and associate professors are not available to mentor young scholars in matters of research and publications. It is assumed that due to the financial constraints and large classes, the senior members could be busy teaching in other universities or performing university administrative duties. It takes collaborative effort to produce knowledge (Jaybay 1998).

4.2.3 Gender Role Stereotypes

Some of the women researchers (11.66%) reported that gender related roles are usually a major obstacle for them to conduct research. They uncovered that women were subjected to pressures and experiences not met by men. These pressures included feelings of isolation, strain in coping up with stereotypical sex role and the whole experience of pressure from institutional and societal cultures that are not supportive of women. This could be attributed to the fact that in many Kenyan communities, traditional perceptions of women as inferior to men continue to prevail as many people invoke the preservation of African culture to justify the subordination of women. In recent years, women’s participation in research activities in the world of academia is being advocated for. There are some universities which have set aside a research fund for female scholars. However, the socio-cultural barriers preventing women from conducting research and the attitudes in the higher education system, especially of the academic community towards women’s access to knowledge is questionable. These findings are in agreement with Kamau’s (2001), study where she indicated that lack of policy and practice aimed to encourage women to research was the main hindrance to participate in research activities.

4.2.4 Lack of Commitment and Interest towards Research

It was reported by 13 (21.66%) of the respondents that there was lack of interest and commitment to research among dons. This was attributed to lack of motivation where they perceive research as extra work with no additional pay. Some scholars argued that the writing process was too cumbersome and time consuming. Fear of modern technology was also cited as a cause for lack of interest and commitment. According to Khan, Hasan & Clement (2012), if teachers want to successfully use technology, they need to possess a positive attitude to the use of technology. Sometimes, the lack of interest could be due to laziness, poor reading culture, or lack of mentorship. Such lecturers in Kenyan universities would like to be promoted on the basis of teaching and grading students alone especially those at the levels below the rank of a professor. Yet, this undermines the development of research and publication activities in the university.

Another reason for lack of research commitment among academics is closely related to the high rejection rate of manuscripts, especially those by first attempt authors. Worsham (2008) confirms that the acceptance rate of any good scholarly journal is typically quite low, so the chance of rejection is always relatively high. Summers (2001), mentions that the rejection rate of leading international research journals currently averages around 90%. A study among editors of 73 accredited South African journals also confirmed an exceptionally high rejection rate.

Writing is considered by some academics as hard work and it requires adequate preparation. Sometimes, scholars expect that inspiration will just appear and make their writing magical overnight. It is important to recognize that scholarly writing is a gradual process that should be guided by personal commitment and stringent personal discipline. Peer reviewing for example can be a barrier to publishing particularly in reducing complete manuscripts for publication (Waddell, 2002). The long process that a scholar has to wait for before an article is finally ready for publication is discouraging to scholars.

4.2.5 Ethnicity and Poor Institutional Governance

According to 28 (46.66%) of the respondents, ethnicity and poor institutional governance has taken the role of racism in Kenyan universities in terms of discrimination. This has impacted negatively on research and publication among scholars. Ethnicity has been one of the social problems since independence in Kenya. However, universities are expected to become instruments of national integration but it is sad that over 50 years along the line, that dream has not been realized. Education Cabinet Secretary Fred Matiang’i has cited ethnicity as a major challenge in hiring of staff in the institutions of higher learning in Kenya.

The nexus between ethnicity and university research has been compromised. Council members, vice-chancellors and other senior administrators are often selected from an institution’s immediate surroundings. This means that appointments, promotions, research funds, conference facilitation including other resources that can facilitate research are given discriminatively along ethnic lines, sometimes with no consideration of merit. It is not surprising that in 2016 the political leaders in Uasin Gishu County were demonstrating against the newly appointed acting Vice Chancellor of Moi University whom they were accusing of not being from their tribe. The political leaders wanted the Cabinet Secretary to appoint a Vice Chancellor from among the top professors in the university from the local tribe. The University of Eldoret also erupted into open warfare in February 2015 because locals felt that members from other ethnic groups had been promoted at their expense.

The university governance question is yet another social-cultural challenge that faces universities in Kenya. Ethnicity has resulted into poor institutional governance in Kenyan universities. Poorly managed universities have cases of corruption, ethnicity, embezzlement of funds, lack of clear structures among other vices. For example, through corruption and ethnicity, under qualified academic members of staff are appointed or promoted. Such under qualified members do not add any value in terms of research output to the institutions. Quality academic, highly trained and experienced staffs are central to building a strong and well-functioning university with regard to research. Furthermore, a poorly managed university does not create a conducive environment for research. These findings are in line with a study conducted in Nigeria by Oke.G.G et al (2010) that in Nigeria on leadership behavior of university Vice-chancellors and its implications to the work behavior of academic staff. The authors found out (among various hypotheses tested) that ‘the lecturers’ level of perception of their Vice-chancellors leadership behavior has a significant
relationship with their level of participation in university activities'. This implies that in order to enhance lecturers' participation in university activities such as research, a Vice-chancellor need to exhibit positive leadership behavior.

4.3 Political-Related Challenges

Apart from the economic and the socio-cultural challenges, 20 (9.09%) of the respondents reported political-related challenges to research as summarized in figure 6 below:

![Fig. 6: Political challenges](image)

**Source: Author 2017**

### 4.3.1 Political Suppression

According to 5 (25%) of the respondents, political suppression among researchers has led to the limited academic freedom. In Kenya's universities, intellectual freedom has always been under siege. The relationship between the state and higher education has been characterized by suppression, arrests, detention without trial, and even the deaths of anti-establishment academics and students. This has been done by use of government resources and the police system, in league with university administrations, to smother critical dialogue. Intriguingly, the kind of critical discourse and political activism that withstood these pressures in the 1970s, '80s, and '90s seems to have faded in the last two decades.

Knowledge production requires an environment that favours free flow of information, limited censorship and free exchange of and sharing of ideas (Nonaka and Takeuchi (1995). Freedom of expression in most sub-Saharan countries is so much scuttled that one may as well say it is absent to a large extent. Scholars, especially in the Humanities and Social Sciences restrain themselves from publishing what they think may not be viewed favourably by those in power. Publishing anything critical of those in authority may be a reason for denial of promotion or such individuals can be tried and/or be arraigned before the courts of law, convicted and sent to jail for being found guilty of crimes bordering on treason.

### 4.3.2 Political Appointments

Politicians in many cases have tried to influence appointments of the top leaderships of public universities. This is according to 5 (25%) of the respondents. Political appointments have led to political interference when it comes to the smooth running of the university. Most scholars in sub-Saharan Africa are affiliated to or employed by universities. The universities in the region do not enjoy autonomy and freedom of existence. The country's politicians keep on meddling in university management affairs. Chief executive officers and other high ranking officers in the universities are government appointees who are mostly appointed based on political considerations. Because of the political environment in which universities in sub-Saharan Africa operate, scholarly publications which are critical of the government of the day are highly censored and discouraged. Chakava, a prominent publisher in Kenya summarizes the kind of environment in which a public university in Kenya and elsewhere in sub-Saharan Africa operates:

> “The university as an institution has been largely politicized and a majority of university professors are absorbed into the state system. Creativity is stifled through the curtailment of literary seminars, journals, and writers’ workshops, and a general lack of facilities or incentives to promote and reward academic excellence. There is lack of an intellectual culture and debate on important issues of the day.” (Chakava, 1996).

### 4.3.3 Political Instability

According to 5 (25%) of the respondents, political instability in the country is another challenge to research. Every year when there is general election in Kenya tensions and sometimes fighting erupts between ethnic groups emanating from election disputes. This was witnessed in 2007/2008 post-election violence (PEV) that left over 1300 people dead in various parts of the country and a majority displaced. In some instances, the
lecturers who were teaching in universities located in the opposition zones and vice versa feared for their lives. Some had their homes torched and others even lost their lives and property. In fear of their lives, many sought employment in universities which were in their locality where they felt safe. During such times, little is accomplished in terms of research-related activities.

In the 2017 elections, the same political tensions are exhibited. This time the contest is between Mr. Uhuru Kenyatta (Kikuyu) of Jubilee Party and the opposition leader Mr. Raila Odinga (Luo) of the National Super Alliance (NASA). Mr. Raila is being supported by Mr. Kalonzo Musyoka (Kamba) Mr. Uhuru has William Ruto (Kalenjin) as his supporter. This has caused a lot of tension in higher institutions of learning especially as Kenyans wait for the repeat polls slated for October 26 after the Supreme Court annulled Uhuru's win in the August 8 polls. In such unstable political environment, scholars are unable to conduct any meaningful research.

Due to such political instabilities, the office of the president has stopped hundreds of academics from leaving the country to attend conferences and research related work; a move that beats the essence of learning. The Director of immigration Mr. Kinyua has directed: “no government official will be allowed to leave the country without clearance by the president.” It is well known that universities can barely fund international conferences. Most academics rely on International networks, self-funding and research projects to fund international travel. Such a ban by the government is therefore, attacking the cherished ideals of academic freedom. Knowledge is transnational, and the most impactful and successful academics make overseas trips to network, share knowledge and increase research visibility.

V. RECOMMENDATIONS

The study recommends that:

1. Information, Communication and Technology infrastructure should be expanded to facilitate access to research materials by teaching staff and other stakeholders. Availability of computers, laptops, networks and other relevant infrastructure will improve research activities among scholars.

2. Universities should prioritize research-related activities in budgetary allocations and formulate appropriate and operational research policies to guide the universities towards successful research such as conference attendance and creation of a conducive research environment among others.

3. Universities should organize comprehensive training and mentorship programmes of lecturers on research skills and ICT skills which are among critical determinants of successful research.

4. There should be collaborations and partnerships with other successful researchers in other countries in a bid to acquire best practices to accelerate research work. Such collaborations would be but not limited to areas of research and publications (editing Journal articles, review of articles, joint writing of conference papers), sandwich doctoral training, Post-doctoral Research Fellowships, library acquisitions, information sharing on scholarships and research grants’ (Tettey 2006).

5. Some widely indigenous languages in sub-Saharan Africa should be considered for scholarly communication by sub-Saharan African scholars such as Kiswahili and Afrikaans.

6. Many sub-Saharan African countries are well endowed with natural resources, which if well managed can generate tremendous revenues, which can be used to improve remunerations of indigenous scholars and other highly qualified professionals. Such revenues should be used to equip libraries and laboratories, which scholars use for research and generation of new knowledge.

7. The Commission for University Education (CUE) is mandated by law to regulate higher education in Kenya and has outlined the criteria for qualification for each category of the faculty in both public and private universities. These criteria should be strictly adhered to. This will ensure that recruitment, appointments and promotion of potential candidates and existing ones is done professionally. ‘African universities therefore should foster transparency, by ensuring that appointments are anchored in a representative committee system at every level’ (Tettey 2006).

8. There should be leadership training programme for Vice-chancellors and other members of the university top management. This will help African University leaders to be better governors for better service delivery; which is very crucial in building a conducive research environment for members of staff.

9. Universities should formulate equal opportunity policies, changing the environment in which women work, and the attitudes towards educated women, flexibility in working hours, and reviewing of recruitment and promotion policies in higher education. (UNESCO 1994).

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Influence of Governance and Institutional Structures on Flood Management and Control in Kilosa District, Tanzania

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Abstract- Many people lose their lives each year due to disasters in Tanzania, with a vast property damage. When compared to others, floods are the number one damaging economics and causing loss of lives. The Mkonda River is one of the biggest rivers which causes floods in Kilosa District. This article, has explored the influence of governance and institutional structures on the management and control of floods, in the four villages adjacent to Mkonda River in Kilosa District. The fundamental argument of the article is that, the existing governance and institutional structures are insufficient in terms of providing structural and non-structural measures before, during and after floods. This is mainly because of the top-down decision making set up, inadequate funding, lack of disaster experts, and the delay of reliefs to flood victims. The article also identifies that, these problems were in place due to economic, political, environmental, and social settings. It is concluded that, efforts are needed to strengthen the performance of governance and institutional structures particularly in creating a network of flood management actors, which the responsible institutions should involve the community accordingly, in the processes of managing and controlling floods.

Index Terms- Flood, Governance, Institution, Kilosa.

I. INTRODUCTION

A wide body of scientific literature in the world (Loster, 1998 and Mioc et al., 2008), has consistently acknowledged that, floods are among of the natural disasters which occurs in many parts of the world, causing deaths and injuries of people and destruction of properties.

International Strategy for Disaster Risk Reduction (ISDR), (2017) also acknowledged that, floods accounts for 6.8 million deaths in the current two decades of the 21st Century and have affected more than 2.8 billion others worldwide. ISDR, (2017) further posited that, deaths due to disasters from weather-and climate-related events (floods in particular), accounted for the many deaths in most years and there has been a sustained rise, more than doubling, over the past forty years.

Records further hold that, Asia is the most flood affected region, accounted for nearly 50% of the flood related fatalities in the last quarter of 20th Century (Doocy, 2013), whereby China, India, Nepal, and Bangladesh attracted great attention throughout the world (Loster et al., 1998).

Regarding to that, floods exacerbate negative impacts around the world, governance and institutional structures have been in place to ensure that, the vulnerability and effects are minimized. The core role of these governance and institutional structures, include among others, to predict climate change and produce assessment reports which raise awareness on floods and suggest actions needed to minimize the effects (World Meteorological Organization, 2011).

Africa like other continents similarly, has not been spared by the incidences of floods. UNEP & UNESCO, (2011) reported that, many people in Africa (about one billion) were vulnerable to floods. Floods in the continent have been driven out by different factors such as having unplanned human settlements in flood prone areas, which appear to play a major role in increasing flood risk (Di Baldassarre, et al., 2010). Poverty, has also cited as an underlying factor which influenced people to live in areas which are prone to floods in Africa (Douglas et al., 2008).

Furthermore, most African countries have been combating floods by establishing institutional and governance structures. These governance and institutions structures, have been dealing with various activities including weather forecasting, although they have been using low technologies (Leijnse, et al., 2007). Other activities encompasses raising of people awareness on preparedness, urban planning, and discouragement of human settlements in flood prone areas (Di Baldassarre, 2010).

As for Tanzania, throughout much of Africa, many rural and urban communities have been also experiencing at varying degrees flood risks, which have been resulting to severe effects at both household and national level. Regions which have been often susceptible to floods in the country include Dar es Salaam and Morogoro (Senga, 2007), just to mention a few.

In terms of Morogoro Region, Kilosa District in particular, records indicated that, there have been frequent floods in the District since 1930’s, principally due to the overflow of the rivers, including Mkonda river (UNICEF, 2013). Due to that, the colonial government had built water reservoirs and levees along the river to prevent floods. Nevertheless, because of the lack of regular maintenance, the levees and check-dams for reserving water broke out (Maringos, 2014). This has caused Kilosa District to be the worst flooding area in the country (URT, 2005).
The study area has been selected based on riverine flood prone area, flood data availability, diverse socio-economic characteristics, and accessibility. Four villages (Kiyangayanga, Mbwamaji, Mbumi A and Mbumi B) of Kilosa District in Morogoro region (Tanzania) were involved in this study. The District lies between 6°S and 8°S, and 36°30’E and 38°E as well as a flat lowland which has covered the whole of the eastern part.

Kilosa District has a semi-humid climate, receiving an average rainfall of 800 mm annually. The temperature ranges from 25°C and 28°C and is divided into three zones which are flood plain zones with an altitude of about 550m made up of poorly drained, black cracking clays in the central parts subjecting to seasonal flooding. Plateau zones with an altitude of around 1,100m made up of moderately fertile, well drained sandy soils which are highly erodible (Burgess et al., 2007). A highland zone with an altitude up to 2,200m which is made up of highlands (Kilosa District Council, 2010).

The human population of Kilosa District was 438,175 people (URT, 2012). Regarding to the major livelihood groups in the District, more than 80% of the people depended on agriculture and forest based resources for their livelihoods (Kilosa District Council, 2010). Pastoralism also is another economic activity in the District.

The researcher and field assistants administered questionnaires to 100 respondents by face to face to achieve both qualitative and quantitative data. Questionnaires were pre-tested to check wording, clarity, layout, and recruited four local field assistants and they had different issues including respondents’ socio-economic background, available governance and/or institutions structures, for managing and controlling floods and their activities, as well the effectiveness of those governance and institutions structures in curbing floods.

2.2.2 Focus group discussions
Formal discussions were held by involving local leaders, males, females, and pupils. Each group had three participants. Members in each group, concentrated on a number of issues dealing with the governance and/or institutions structures arrangements in flood management and control, as well the level of coordination and participation between the local people, governance, and institutions.

2.2.3 Key informant Interviews

The researcher, also held formal interviews with persons whom played a spontaneous role in acquiring knowledge on different aspects of life, both within the community and from outside, and also got opportunities in their daily engagement to share and disseminate information. They include local leaders, professionals, and residents whom have firsthand knowledge about the community and experience of floods in the area. Interviews were intended to reveal understandings, expectations, and perspectives relating to the influence of governance and institutional structures arrangements, in flood management and control. They also included views, ideas, and suggestions, on how the governance and institutional structures could facilitate the sustainable management and control of floods.

2.2.5 Document review
Secondary data were accessed through books, journals, and official reports. Documentary review was used to identify the link between governance and/or institutional structures and flood management and control practices. The review was also used to get an understanding of the issues related to the thematic research area. For example, such information as flood management practices and institutional coordination, perceptions on flood management and control practices and tools/approaches of flood management and control.

2.3 Data analysis

II. MATERIALS AND METHODS

2.1 The study area

The study area has been selected based on riverine flood prone area, flood data availability, diverse socio-economic characteristics, and accessibility. Four villages (Kiyangayanga, Mbwamaji, Mbumi A and Mbumi B) of Kilosa District in Morogoro region (Tanzania) were involved in this study. The District lies between 6°S and 8°S, and 36°30’E and 38°E as well as a flat lowland which has covered the whole of the eastern part.

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2.2 Data collection

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Collected data were cleaned, coded and for the quantitative data they were analyzed through the usage of the Statistical Package for Social Sciences (SPSS) 16.0 computer programs, for windows. Qualitative data were analyzed by using the content analysis technique, which mainly involved the transcription of the recorded note books and then clustering information into sub-themes.

III. RESULTS AND DISCUSSIONS

3.1 Socio-economic background of the respondents

Respondents’ age, sex, education, and occupations were assessed. The study had a total of 100 respondents of whom 72.41% were males and 27.58% females. Reasons for males to participate more in this study could not be established. However, this could have happened by a chance. As for the ages, 66.33% of the respondents were aged between 41 and 80 years and 31.83% between 21 and 40. This implied that, many of the people were economically active.

In terms of education, results showed that, 64.33% of them had attained a primary school education and 15.25% secondary education. This implied that, many of the villagers had a little level of education which might have the implication in flood management and control. Regarding the occupation of the respondents, results have disclosed that 63.75% had farming and livestock keeping as their primary occupations. Others were engaged in businesses like shop keeping, motorcycle business locally known as bodaboda, welding, carpentry, catering locally known as baba and mama lishe, and tailors (Table 1).

Moreover, 67.58% of them were married. By considering households’ income status, almost 65.48% of them had an average monthly income below 50,000 Tsh. ($ 22.34) per month. This portrays the actual situation of the rural poor whom depends on subsistence farming as a principle source of income.
3.2 Governance and institutional structures for managing and controlling floods.

Governance and/or institutions structures dealt with flood management and control, were assessed at both national and local level. At the national level, floods as other disasters, are under the mandates of the central government (Prime Minister’s Office Department of Disasters) and the local government (District/Town Councils as well as Ward and Village Councils). According to the National Disaster Management Act (URT, 2015), the central government is responsible to formulate a disaster policy and regulatory frameworks, promote and facilitate coordination of various stakeholders, whom are engaged in disaster management at all levels. Regarding the local government authorities, they have to implement the disaster Act and policy in their areas of jurisdiction. Furthermore, the

Table 1: Socio-economic background of the respondents

<table>
<thead>
<tr>
<th>Socio-economic background</th>
<th>Kiyangayanga (n=25)</th>
<th>Mbumi A (n=25)</th>
<th>Mbumi B (n=20)</th>
<th>Mbwamaji (n=30)</th>
<th>Total (%)</th>
<th>Average (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>4.04</td>
<td>1.01</td>
</tr>
</tbody>
</table>

government recognizes and acknowledge the role performed by private sector and NGO’s in disaster management.

As for the study area, results have revealed that, 70.83% of the respondents disclosed the presence of governance and institutional structures, which were involved in one way or another in flood management and control (Table 2). They included Ward and Village government offices and Disaster Management Committees at the Ward, Village and Sub-village levels.

The possible reasons for the majority of the respondents to be able to identify these governance and/or institutional structures, could plausibly be the good awareness among the local people concerning the structures and their several participation in electing leaders.

Regarding to the leadership of these institutions, the Wards are under the Ward Executive Officers (WEO’s), the Villages are under the Village Chairpersons and Village Executive Officers (VEO’s), and Streets are under the Streets Chairpersons. As for the disaster management committees, they are under the Chairpersons and Secretaries whom are obtained through village and streets voting, by appointed, as well by government recruitments.

Notwithstanding, most of the identified governance and/or institutional structures, were not functioning well to manage and control floods as was observed by 65.75% of the respondents, due to lack of local people participation in decision making, illiterate of leaders, funding, disaster experts, and the lack of disaster management guidelines at the local level.

### Table 2: Flood governance at local level

<table>
<thead>
<tr>
<th>Village</th>
<th>Government Institutions/ Structures (%)</th>
<th>Type of institutions/ structures</th>
<th>Functional (%)</th>
<th>Reasons for mal-function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiyangayanga</td>
<td>Yes 52 No 48</td>
<td>Ward and Village government offices, Disaster committees</td>
<td>Yes 40 No 60</td>
<td>Limited local people participation in decision making, lack of disaster experts in the committees</td>
</tr>
<tr>
<td>Mbumi A</td>
<td>80 20</td>
<td>Ward and Village government offices, Disaster committees</td>
<td>34 66</td>
<td>Lack of involvement of local people in decisions, lack of disaster experts in the committees, illiterate of the local leaders.</td>
</tr>
<tr>
<td>Mbumi B</td>
<td>80 20</td>
<td>Ward and Village government offices, Disaster committees</td>
<td>43 57</td>
<td>Lack of funding allocated for disaster management, lack of disaster experts, lack of local people participation in decision making</td>
</tr>
<tr>
<td>Mbwamaji</td>
<td>71.33 28.67</td>
<td>Ward and Village government offices, Disaster committees</td>
<td>20 80</td>
<td>Illiterate of the leaders, lack of funding for disasters, lack of detailed disasters reports in the meetings, lack of disaster experts, lack of disaster committees guidelines</td>
</tr>
<tr>
<td>Total</td>
<td>283.33 116.67</td>
<td></td>
<td>137 263</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>70.83 29.16</td>
<td></td>
<td>34.25 65.75</td>
<td></td>
</tr>
</tbody>
</table>

What can be deduced from this scenario is that, top-down approach has been used in decision making. Therefore, local structures and institutions remained as recipients of orders and decisions from higher levels. The situation however, could be worse as the local level institutions were similarly lacked disaster experts and they were also poorly funded. Discussions, with Ward and Village leaders have revealed that, they had no mandate to mobilize funds for flood management and control, without a permit from higher levels. For this, they have to wait until floods engulf their areas, then it is where they can raise their voice for asking help from the District and Regional Offices.

### 3.3 Activities attempted by governance and institutional structures

Study results have indicated 64.17% of the respondents posited that, there were activities performed by the local governance and institutions to manage and control floods (Figure 2). They encompassed the construction of river embankments, rehabilitation of the damaged roads, assessment/evaluation of the damages, planting of trees alongside Mkondoa River, and the distribution of reliefs. The District Coordinator of Climate Change and Statistics also added that, the governance and/or institutions were also providing District climate change predictions, education, and prohibiting anthropogenic activities, such as charcoal making and farming close to Mkondoa River and other water sources.

Other functions include keeping office records, protecting office properties, searching and inter into agreement, with
stakeholders whom involved in flood management and control practices.

However, it was claimed by respondents that, activities were not carried equally. Claims were raised mainly by people from Magomeni Ward (Kiyangayanga and Mbwamaji Villages). They posed that, they were been ignored in terms of assistance whenever floods occur. They further aired out that, assistances were pushed to the other side (Mbumi Ward).

This study has disclosed that, this situation was in place in view of the fact that, most of the local administrative offices, were in Mbumi Ward like a primary court, schools and other local government offices. Therefore, the closeness of these local institutions in Mbumi Ward, could influence an easy accessibility of the aids and information when compared to people from Magomeni Ward whom were far.

During field site visits, many of the activities which respondents and key informants stated were that, the governance and institutional structures which attempted to manage and control floods were observed. Some of them include planting of reeds at the banks of Mkondoa river and placing of posters, which restricted to conduct anthropogenic activities within 100 meter from the Mkondoa river (Figure 3 and 4 below), just to mention few.

Apart from that, the level at which the governance and institutional structures had achieved to manage and control floods in the study area, was also explored so as to understand whether they had succeeded or not. To get answers for it, respondents were asked to what extent they ranked the achievements made, based on the following response categories: very low, low and moderate. Results have indicated that, majority of them had views that, achievements were less (Figure 5), because the impacts were escalating whenever floods occurred.

Various factors were raised for such failure, including biasness in the distribution of relief/aids and poor rehabilitations of the damaged infrastructures over a long period of time for example the embankment (‘tuta’) in Mbumi Village.

Residents whom were in flood prone areas also were promised for a long time that, they would be relocated to safer places without implementation. However, the government
institutions in place relied much on private institutions to provide aids to victims. Other reason furthermore, was the weak economy at household level, as many of the surveyed respondents (65.48%) stated that, their monthly income was ≤ Tsh. 50,000 (Table 1).

Respondents further revealed that, some of the activities like planting of reeds and trees, have been lacking monitoring and evaluation. Their views lines with the Village Chairperson of Kiyangayanga who cemented that;

“Activities are not active due to inadequate funding provided from the government and other stakeholders. This make some initiatives like afforestation to wind up before achieving the set up goals”.

From these findings, delay of aids are the major problems which constrained governance and institutions efforts to tame floods. Respondents have claimed that, delays were present because of the long time taken to carry out needs assessment (evaluation), which were supposed to be done before distribution of aids.

Other factors for the delays, include the late mobilization of aids from stakeholders and inaccessibility of some areas. In this respect, people had the idea that, their life was not given priority. The respondents have also claimed that, some aid providers favored their fellows (friends) firstly.

They further claimed that, those whom were against them politically, they were not considered and given priority in receiving aids even if they were worse affected. This scenario implied that, the political ideology or politicization had an influence in floods management and control.

With regards to bureaucracy, it was also reported to hinder smooth functioning of the governance and institutions interventions carried, to manage and control floods (Table 3). They reported that, there was a long process which had to be
The assessment furthermore indicated that, there was a lack of disaster experts at the local level. This study has found out that, the Ward, Village and Sub-village leaders were merely political leaders whom had no a background in disaster management. This was similar to the Ward, Village, and Sub-village Disaster Committees. Chairpersons and members of these committees lacked a background in disaster management. It was also revealed that, none of the leaders and members of the committees had received any form of training in disaster management, floods in particular. They were working without disaster guidelines as a result, they failed to achieve the desired goals.

As already discussed, various actors were involved to manage and control floods. These brought with them experiences, resources, and technical know-how, which were left to the local community. Although the communities have a long list of local potential capacity, they still needed professionals/experts to advice in various aspects, in order to be able to smoothly implement the planned activities.

The lack of disaster experts, is also related to institutional failures to train experts. Currently there is no middle level disaster management training institutes in the country. The only institutions capable of training disaster experts are the Ardhi University and the University of Dodoma. However, the number of graduates is few compared with the country’s demand.

IV. CONCLUSION

Results of the study have revealed that, there were some milestones which governance and institutional structures had achieved to manage and control floods. The improved aspects included communicating higher levels, distributing aids, and assisting the evaluation of the damages. However, despite the observed achievements, it was identified that, there were lack of disaster experts, bureaucracy, and poor coordination of the stakeholders.

Measures are required to solve weaknesses such as formation of the flood working plan, so as to increase the effectiveness in flood management and control, forming aids committee which would ensure time to time auditing of funds and other non-financial aids, located to the socio-economic projects on are spent, to recruit skilled and experienced people in disaster management and conservation, as well as strengthen security and safety committee at the local level.

It is similarly recommended that, there should be a network comprising the District Disaster Committee, local (ward and village/streets) disaster management committees, and local non-govern mental organizations, and local media.

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AUTHORS

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Exploring Sudanese University EFL Learners’ Pragmatic Competence

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Abstract- This study attempts to investigate Sudanese EFL students’ discourse to appraise their nonverbal communication, expressive skills, topic maintenance, and their ability to abide by speech conventions during their social interaction. The subjects of the study comprise 40 fourth level students who are taking English as a major course at Kassala University. To collect the data for the present study, a questionnaire and a free discussion panel with the students were employed. Analysis showed that Sudanese EFL students did not experience any sort of problems with regard to nonverbal communication. They could speak clearly with varied and appropriate tone and volume. The study also showed that only a few students had the ability to develop the topic being discussed skillfully without repeating one point over and over again. This reveals students’ linguistic weakness and their inability to verbally communicate their thoughts. The study concluded that the students never attempted to use figurative language which made it difficult to be certain whether the students could use metaphor properly or otherwise. To interact effectively within a particular discourse community, students should know that it is not sufficient to be skillful in nonverbal communication and ignore the role of language in this domain. Students should activate both nonverbal and verbal aspects of communication in order to effectively express their thoughts and feelings. It is the job of teachers to train their students in this respect.

Index Terms- pragmatic competence; communicative function; social interaction; language functions

I. Introduction

Purpura (2004) claims that language is primarily used to transmit information, to perform transactions, to establish and maintain social relations, to construct one’s identity or to communicate one’s intentions, attitudes or hypotheses. Kiesling and Paulston (2005) state that the interaction of language with social life is viewed as, first of all, a matter of human action, based on the knowledge that enables persons to use language. Many young people who are starting work life, as stated by Rowson (2007), lack this knowledge. Sperber and Wilson 1986/1995, 173) claim that language is an essential tool for the processing and memorizing of information. This entails that users of language depend on their cognitive abilities when they set to use language for different interpersonal purposes. Most of the teaching situations in the Sudanese classrooms still adopt the traditional approaches to language teaching and learning; the communicative value of the linguistic forms is not considered. Much emphasis is put on the grammatical and lexical properties of the linguistic forms. How these forms can be used in a real communication is not considered. So, the ability to use language in order to express their intended meaning properly is one of the problems encountered by Sudanese university EFL learners. The students experience difficulties abiding by the socio-cultural rules of language use. Their ability to develop the language they have studied into a socially accepted discourse always remains under question.

II. Background

Crystal (1985: 240) defined pragmatics as the study of language from the point of view of the users, especially of the choices they make, the constraints they encounter in using language in social interaction, and the effects their use of language has on the other participants in an act of communication.” So as stated by Yule (1996) pragmatics deals with the relationship between linguistic forms and the users of these forms. This entails the ability to employ linguistic forms to perform particular language functions properly. According to Saville-Troike (2006), pragmatics can be defined as what a speaker must know in order to interpret and convey meaning in communication. Similarly, Kasper (1997) defined pragmatic competence as the knowledge of communicative action and the way to carry it out, and the ability to use language appropriately according to the context. Mey (2001) states that pragmatics studies the use of language in human communication as determined by the conditions of society. He holds that communication in society happens chiefly by means of language. However, the users of language, as social beings, communicate and use language on society’s premises; society controls their access to the linguistic and communicative means. Pragmatics, as the study of the way humans use their language in communication, bases itself on a study of those premises and determines how they affect human language use. Leech (1983: 6) defines pragmatics as 'meaning in relation to speech situations'. This definition highlights language users’ ability to use language for different communicative purposes in different situations. Zuferey (2010, 39) contend that pragmatic competence can be manifested in several acquisition processes, namely, 1. The acquisition of communicative intents and the development of their linguistic expression, including the conduct of communication prior to the emergence of speech – that is by vocalizations and gestures. 2. The development of conversational
skills and the acquisition of rules that govern turn-taking, interruptions, back channeling, signaling topic relevance or topic shift and so on. 3. The development of control over the linguistic devices used to organize discourse in ways that are cohesive and genre specific. 4. Pragmatic learning processes that operate in children’s entry into language, such as the acquisition of novel linguistic forms by pairing them with their inferred communicative function rather than their semantic meaning. 5. The acquisition of rules of politeness and other culturally determined rules for using speech. The notion of pragmatic competence and how it can developed should be one of the aims of the Ministry of Education in Sudan when devising the English language teaching programs.

III. METHOD

3-1- Participants

The participants in this study included 40 Sudanese EFL students who are taking English as their major at Kassala University. The students take courses in the English language, the English literature and linguistics. Theoretically, these courses must equip the students with the knowledge of English – the knowledge they need to be active future practitioners of English in Sudan. Practically, Sudanese researchers believe that the situation of English as a communicative tool in Sudan is deteriorating.

3-2- Instruments

Two tools were used to collect the data for this paper: a questionnaire and a free open discussion panel. Adopting two different tools is a guarantee of eliciting more comprehensive and reliable data which could lead to reasonable and promising results.

3-3- The questionnaire

The questionnaire was designed to obtain information about how Sudanese university EFL learners appraise their own pragmatic competence. It evaluates the students’ ability to develop the language they have studied into a socially accepted discourse. The questionnaire comprises four sections. Section one deals with students’ competence in nonverbal communication. Section two involves students’ expressive skills. The third section examines students’ ability to develop certain topic into an effective piece of discourse. The fourth section evaluates and assesses students’ ability to use English as determined by the discourse community of the users of English.

3-4- The Free Discussion Panel

The discussion represents an effective tool to elicit realistic and reliable data about participants’ ability to appropriately interact verbally and nonverbally within a discourse community of the English language users. The data obtained from the discussion and the result of the questionnaire are expected to add to the validity and the truth condition of the data elicited for the current study.

IV. RESULTS AND DISCUSSION

In discussing the results of this study, statistical results of the tables (1,2,3) and the result obtained from the students’ actual spoken performance were thoroughly examined.

Table (1) Students’ Evaluation of their Nonverbal Communication

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I Look at the eyes of the person speaking with.</td>
<td>36</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>90%</td>
<td>10%</td>
</tr>
<tr>
<td>2</td>
<td>I use facial expressions appropriate to content of words.</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>67.5%</td>
<td>32.5%</td>
</tr>
<tr>
<td>3</td>
<td>I Understand the facial expressions of others and respond appropriately.</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>4</td>
<td>I understand the emotions of others and respond appropriately.</td>
<td>33</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>82.5%</td>
<td>17.5%</td>
</tr>
<tr>
<td>5</td>
<td>I recognize nonverbal cues and gestures (body language).</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>67.5%</td>
<td>32.5%</td>
</tr>
<tr>
<td>6</td>
<td>I act at an age-appropriate level.</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>67.5%</td>
<td>32.5%</td>
</tr>
<tr>
<td>7</td>
<td>I recognize the spatial relationships between people or objects and self; I stand the appropriate distances from others.</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>67.5%</td>
<td>32.5%</td>
</tr>
</tbody>
</table>
The students assume that they do not experience any sort of problems with regard to the nonverbal communication. Their answers of the questionnaire assert this fact. Observing students while communicating, proves that they are true. The question of verbal communication seems not to bother the students; they can deal with this matter in such a way that can be accepted by the native and other speakers of English.

### Table 1. Students’ Expressive Skills

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>I speak clearly.</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>9</td>
<td>I speak with varied and appropriate tone and volume.</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>52.5%</td>
<td>47.5%</td>
</tr>
<tr>
<td>10</td>
<td>I am able to accept another person’s viewpoint.</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>11</td>
<td>I do not keep repeating one topic, as if unaware of another’s interest.</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>57.5%</td>
<td>42.5%</td>
</tr>
<tr>
<td>12</td>
<td>I understand sarcasm.</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70%</td>
<td>30%</td>
</tr>
<tr>
<td>13</td>
<td>I understand and use metaphor appropriately.</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55%</td>
<td>45%</td>
</tr>
<tr>
<td>14</td>
<td>I let go of an argument, even if the other person does not agree.</td>
<td>22</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55%</td>
<td>45%</td>
</tr>
<tr>
<td>15</td>
<td>I understand others’ state of mind and can respond to all sorts of inquiries.</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Most of the students assume that they are skillful talking about the so-called expressive skills. They maintain that they could speak clearly with varied and appropriate tone and volume. The students state that they can accept the view of others so that the communication in which they are involved can proceed smoothly. The students also claim that they do not keep repeating one topic while conversing. This does not appear to be true observing them communicating. Only a few students were able to develop the topic being discussed into a more fluent and effective discourse act. Most of the students keep repeating the same point again and again. This reflects their linguistic weakness. The students state that they can understand sarcasm. This also seems to be true; the students do not experience any problems recognizing this aspect of conversation. The students report that they can understand and use metaphor appropriately. But this does not seem to be true; the students rarely used figurative language during their conversation. So it is difficult to know whether the students could use metaphor during their conversation.

### Table 2. Topic Maintenance

<table>
<thead>
<tr>
<th>No</th>
<th>Item</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>I choose a topic appropriate to setting.</td>
<td>35</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>87.5%</td>
<td>12.5%</td>
</tr>
<tr>
<td>17</td>
<td>I introduce and discuss topic clearly.</td>
<td>34</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>85%</td>
<td>15%</td>
</tr>
<tr>
<td>18</td>
<td>I express relevant information and express it concisely.</td>
<td>25</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>62.5%</td>
<td>37.5%</td>
</tr>
<tr>
<td>19</td>
<td>I maintain a topic in conversation.</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70%</td>
<td>30%</td>
</tr>
<tr>
<td>20</td>
<td>I change topic appropriately.</td>
<td>24</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60%</td>
<td>40%</td>
</tr>
</tbody>
</table>
I understand how to tailor conversations to audience – e.g. peers versus teachers.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>I introduce myself appropriately to others.</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>87.5%</td>
</tr>
<tr>
<td>23</td>
<td>I use appropriate conversational pleasantries (greeting, apologies – response to others).</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>80%</td>
</tr>
<tr>
<td>24</td>
<td>I talk “to” people, not “at” them.</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>62.5%</td>
</tr>
<tr>
<td>25</td>
<td>I ask for help when needed.</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>87.5%</td>
</tr>
<tr>
<td>26</td>
<td>I initiate original (non-redundant) conversation.</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>55%</td>
</tr>
</tbody>
</table>

The students contend that they could properly maintain the topic they discuss. They also report that they are able to introduce and discuss a particular topic in a conversation appropriately. They can provide the right information they need for their communication. They can also discuss different topics in a conversation. Studying the students’ actual conversation, makes it clear that only a few students possess the ability to introduce and discuss different topics fluently and smoothly. It is also apparent that the number of the students who could interact according to what is socially accepted and agreed upon is very limited.

Table 3. Speech Conventions

The students state that they introduce themselves appropriately to others; and that they can appropriately use conversational pleasantries (greeting, apologies – response to others). Taking students’ actual conversation into account, one will discover that this is not true; most of the students failed to introduce themselves properly. It was also difficult for most of them to begin their speech the right way. Asking for help while conversing does not seem to be play any role in the continuum of the strategies students adopt during their communication. However, the students assumed that they seek for help when they were unable to proceed conversing. For this reason their conversation sometimes lacks coherence and unity and their content seems to be redundant.

V. CONCLUSION

Analysis showed that Sudanese EFL students did not experience any sort of problems with regard to nonverbal communication. They could speak clearly with varied and appropriate tone and volume. But the linguistic value of the content of the message they conveyed was very low. The study also revealed that only a few students had the ability to develop the topic being discussed skillfully into an informative and comprehensible discourse. The respondents kept repeating one point over and over again which reflected their inability to verbally communicate their thought properly. Furthermore, results indicated that the students never attempted to use figurative language which made it difficult to know if the students could use metaphor properly. The study showed that not all students could introduce and discuss certain topics more fluently and smoothly. It was difficult for them to begin interaction the right way. To interact effectively and properly within a particular discourse community, students should know that it is not sufficient to be skillful in nonverbal communication and ignore the role of language. Both nonverbal and verbal aspects of communication should be activated so that they can effectively express their thoughts and feelings. It is the job of teachers to train their students in this respect.

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Developing Criteria and Design Transformation Process in Designing Landscape Elements Based on Nature and Islamic Principles

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Abstract- In designing urban landscape, there is a lack of consideration in integrating the cultural and environmental resources such as local plants to contribute to the material and design production. A clear understanding on the source of an idea, design process, development and design system is therefore needed. This paper examines the potential of systematic design process in producing designed elements based on the nature (local plants) and Islamic design principles, shapes and forms. The design experiment adopted the framework of design transformation process. Questionnaire surveys were conducted with 159 design students to identify the functions of the design transformation process and its effectiveness in the producing design variations. The results indicated the importance of systematic design processes in producing variation in the design. These findings will support a more creative system in designing Islamic urban landscape that displays a unique identity and suit the local environment and culture.

Index Terms- Design Process, Tiles Design, Design Transformation, Nature, Culture

I. INTRODUCTION

This study focuses on analyzing how the transformation process occurs and how to design an effective system with the understanding of nature growth and the Islamic concept. It requires the understanding of the relevant definition of the concept of transformation in accordance with changes in applications and technology, especially in the context of design research. The Quran emphasizes on the importance of unity, which means Muslims were meant to be a united Ummah, which is justly balanced in nature between the legal aspect of religion and the spiritual dimension, as well as between the internal and the external aspect of life. The integration of Islamic spirituality in symbol design, the stability, harmony and prosperity, the way to live in peace through the Quran will be manifested more meaningfully. This potential could be best seen in nature, the main resource in the environment.

Another aspect in a design that one should focus on is the nature growth. It is to examine the way humans observed nature in design and created systems for creative works. One should study the nature at all levels – from the function and form of biological molecules to the structure and process of tissues and organs, to the behavior and gross anatomy of entire organisms, to the complex interrelations between the numerous species of the ecosystem. The core idea of nature growth and the Islamic spirituality concept is a science that studies nature's ideas and then imitates these designs and processes to solve human problems, with the understanding of Islamic principles. Design Concept is the inspiration from nature resource, provides the designers with combinations of shapes and colors and textures. It is possible to incorporate these basic images into the design. The vision in graphic design is to promote respect for the natural world by incorporating nature into visual design and spiritual values and dimensions.

Nature processes distinctive potential resources in the production of the design process and innovation. The most important considerations in choosing a tile design are a pattern design. Therefore, the importance of focusing on the production process in design has become crucial. The biological, physical and visual aspects of environment influence life philosophy, culture, society, tradition and creativity development. In the production of design symbols, it is evident that there is a lack of focus and assessment given to the production process compared to that of the end product. The importance of the transformation process is emphasized by Charles & Cynthia (1992) who believe that the problem solving processes are shown to illustrate how the process can be altered for use in solving specific types of problem in the design. In this case, the design transformation process is seen as a source of productivity of ideas and its variations for design solutions.

The objectives of this research are to determine the significance of systematic design process and ideas transformation in the development of graphic symbol. This study explores the relationship between tiles production and its pattern within an activity theory framework, focusing on data collected using questionnaire survey from selected universities in Peninsular Malaysia. At the conclusion of this study, design criteria and analysis of system will be established before the production process of decorative tiles design based on tropical plant images.
For thousands of years, artists have relied on the natural world for inspiration, especially designers of pattern in the modern world. Floral pattern designs were chosen because flowers have traditionally been depicted in artwork and decoration since the beginning of visual communication. The artists of the Art Deco style, despite their emphasis on geometric rather than organic line, followed in a long standing tradition and placed great importance on the floral motif in fabric patterning. In fact, at the peak of Art Deco, over half the fabric designs produced depicted floral imagery, most of which was treated geometrically.

II. LITERATURE REVIEW

A. Design Transformation Process

The term transformation is also used in the context of the mind to visual interpretation in the communication process as explained by Alan (2002):

"The process of graphic thinking can be seen as a conversation with ourselves in which we communicate with sketches. The communication process involves the sketched image on paper, the eye, the brain and the hand. All ideas can be said to be connected; the thinking process reshuffles ideas, focuses on parts and recombines them." Alan (2002) relate the term transformation of nature through his statement:

"In the act of transformation into design, some of the disorders of nature are replaced by human order. However, some of the most successful nature-based patterns successfully abstract the natural form, while retaining a liveliness of the overall design that we recognize as being the essence of nature."

The design transformation process can be divided into several layers as follows:

i. The transformation from the point of thinking and creativity: The process relates to how to stimulate ideas and thinking in the development of the mind. Here, the transformation process in the brain, followed by members of the body before translated into paper or by computer.

ii. The transformation of the visual angle and design: The process is divided into two aspects, namely physical (elements) and meaning (principles). Physically, the transformation process created in the form of the size, shape, form, fabric and color. In terms of meaning (principles), it was translated by nature good or bad, soft or hard, balance, etc.

iii. The transformation from the perspective of the nature or character of the environment, such as small or big, fast or slow, smooth or rough, etc.

iv. The process of spiritual transformation from the point of impact is influenced by elements of earth, water, fire and wind.

"This would be in line with changes in scientific thinking that stresses the importance of process in nature, rather than the study of the finished object "(Alan, 2002). Charles & Cynthia (1992) also agreed with the above statement and explained that:

"The process described a series of events, stages or phases that can be viewed in a variety of ways. It is planning, and organizational tool used to guide creative activities toward the end goal.”

The authors through their book ‘Basic Visual Concepts and Principles’ emphasized the importance of the design transformation as a problem solving process through the passage:

“The problem solving processes are shown to illustrate how the process can be altered for use in solving specific types of problem.”

Based on the above discussion, it can be concluded that natural resources such as plants have the potential to be the innovative sources that can provide guidance to the understanding of the transformation process of design, principles of aesthetic design and evaluation of design. The transformation is not only based on the visual aspect, but also from the functional aspects. This passage describes by Ian (1969) regarding the process of transformation that is inspired from natural sources:

“Like their natural counterparts, our designs organize the synchronous movement of many parts into a fluidly transformation whole. One integrates insights from nature into man-made products, environments, and structures. Thus, our approach is inspired by nature, not from a visual standpoint, but rather from a functional one.”

Results based on research theories and approaches above, have indicated that every symbol’s creation should be evaluated in terms of the development of elements in form and structure of the plant images. This method allows one to appreciate the value of the creation process in detail. Alan (2002) considered that a conceptual sketch is based on the concept of man’s thinking relationship to the environment associated with interest in the design process as follows:

“The effect of ecological thinking, taken to its ultimate conclusion, maybe the redefinition of design as a comprehensive awareness of relationships between things and people. This new approach would be in line with changes in scientific thinking that stress the importance of process.” In this regards, Wucius (1995) stated that the conceptual drawings have a close relationship with the shape and structure elements that have been designed. He described that:

“All the visual elements constitute what we generally call ‘form’ which is the primary concern in our present enquiry into the visual language. Form in this sense is not just shaped that is seen, but the shape of definite size, color and texture. The way form is created constructed organized along with other forms is often governed by a certain discipline which we call “structure” that involves the relational elements is also essential in our studies.”

Marcia & Sheila (2005) relate the meaning of transformation in terms of real change. Here, conceptual sketches help in changing forms, image and structure. According to them:

“Often, people confuse transformation with any kind of change, technology breakthrough, innovation, process improvement or transition. However, few changes are truly transformational. However, while all transformation is a change, not all change is a transformation. To transform means a process to change in form, appearance or structure.”

The researcher opines that the conceptual drawings from the point of form and structure are the important elements to creating symbols that are potentially attractive and can be developed into
a more effective and functional forms. It can be understood from the reviews that the process of transformation through the manipulation of shapes and structures of plant images can be produced by means of the conceptual drawings. The drawings describe where the elements or representations of visual composition take place.

B. The Art of Transformations in Islamic Spirituality

Observing the concept of design thinking and Islamic philosophy, one need to understand the meaning of spiritual value, the design process, the art of transformation in visual language, to read in depth of the design. Then only the viewer will appreciate the content of the work of Islamic design. The vision of religion belief is that how the Islamic designers translate their works through forms, colors, spaces. The Islamic Design Concept is the social relation with different environments and culture of the Islamic nation, and through texts from the Koran and the Sunnah, which direct the Islamic concept to the creation of God and human life. In Islamic design, the vision of spiritual religion is the understanding of the unseen was the presence state. The unseen process is where the designers translate the design works through forms, colors, spaces and relations between them and God, interpret them through the solution of this principle in Islamic design. The relationship in their belief is that the process of creation in the artwork, at the same time is the remembrance of God creations.

The end product or the outcome of the design is not the reality; the spiritual process is a reality. For instance, spiritual process of the intention, is a manifestation of God’s creation that reflected as the design intention (The pre-process towards the goal of the design process). The light of the heart is the light flow of idea’s resources that reflected as the source flow from the image origin. The light of the movement is the implementation of the development of the process is reflected as the movement of the design process. The light of the soul is to capture a sense of feeling is reflected as the appreciation of design (the beauty and aesthetic). The light of the mind is to translate action and the results are reflected in the creativity of design. The light of the human structure is for realizing the movement, which reflected as the structure of the elements and principles of design.

The light of desire is to raise the state, of the requirements and spirit that is positive & negative, which reflected as the outcome of a design, to analyze the requirements of its achievement. This method is documented through this concept of abstraction in shapes, units and decorations. It also reflects the intellectual of knowledge in the aspect of the value of the spiritual process and the quality of the work of art in Islamic spirituality.

God’s creation through the spiritual energy that was an impact on the development of science and knowledge and the discovery of molecules constituting the material and the energy contain atoms, created an aesthetics values in design. The essence reflects the concept of Islamic philosophy and manifests the understanding through the design works using design expression. The thinking eye was a combination of visible and invisible in the work of art.

The meaning of the design creations, the systematic process, the principles and values, which was organized through the technical elements in the technical work of design productions involve colors, lines, forms, spaces and its relationships by developing the construction methods and theories. Applications of the descriptive and analytical method by studying some of the concepts and theories related to the field of production in scientific design elements, and principle construction will achieve the Islamic design concept of similarity and simplifications of different culture and visual environment.

There is a relationship between Islamic design and scientific theories. It shows in a positive discovery in visual interpretations, visual transformation, simplifications and innovations. What important of this relationship is the basic understanding of uniformity and the aesthetic acceptance of the work of art. Design science theories and Islamic design influence each other, which reflects how the design work based on knowledge of theories and foundation design through a system of Islamic thought. It can work through the design planning process methods and techniques of the organization of design to generate scientific knowledge used in the new Islamic design concept.

III. RESEARCH METHODOLOGY

A. Manual System of Design Process of Tiles

In the development of a manual system, elements and principles of design should be primarily considered as to identify the criteria for the transformation process through the manipulation of forms and shapes. The methodological framework is designed by selecting the most relevant design elements (see Figure 1). The design phase includes the process of recognizing, refining and strengthening the design criteria by producing more accurate and detailed transformation processes.
The next step is to identify the manual system of design process by separating the criteria into four sections. The criteria include the element of the form, the principles of design, the elements of nature and the form of flow sequence. Figure 1 shows the flow sequence of plants transformation based on four sections that have been developed. A conceptual framework relating to the concept of the manifestation of the light of God towards human beings, quoted from the book of “Secrets of the Human Light” by Baginda Muchtar, was referred to for linking the design criteria with the spiritual concepts rooted from Islamic teaching (see Figure 2). The structure, creativity, beauty, process, symbolic image and the design intention are all regarded as the manifestation of the spirit and knowledge to transform the essence and abstraction of creation to real design elements.

**Transformation Process of God’s Light in human being**

1. **Light of intention** - manifestation of God’s creation in the Light flow
2. **Light of heart** - Light flow resources
3. **Light movement** - to implement the development of light flow
4. **Light of soul** - to capture a sense of feeling
5. **Light of mind** - to translate action & the results
6. **Light of human structure** - for realizing movement (mouth, hands, etc.)
7. **Light of desire** - to rise the state, the requirements and spirit (positive & negative)

**The Perfect Human**

1. **Design intention** – Pre-process towards goal of the design process
2. **Symbol image** – Source flow from the image origin
3. **Movement of the design process** – to implement the development process of symbol design
4. **Appreciation of design** – beauty & aesthetic
5. **Creativity of design** – to translate design solution
6. **Structure of the elements principles of design** – for realizing the process design

**Effective Symbol Design**
B. Criteria of the transformation process in tile design based on plant images

Based on the concepts and criteria reviewed in the study, the production process criterion is developed as ‘framework’ for the tile design experiment described as follows:

i. Criteria for analyzing an image to the tiles design based on plant characteristics and elements of forms.

ii. Criteria for creating the transformation process in accordance with the system from the first plot to the end of the plots based on the principles of form features.

iii. Criteria for analyzing the process of transformation in the image sequence that was generated based on the transformation process flow sequence.

The main focus is to identify the transformation process through the application of features and elements in the character of the plant. The importance of the development of the criteria above has been emphasized by Wucius (1997) that explains:

“The shapes of the components of natural forms and how they work together structurally should then be examined.”

This theory is also supported by Hoberman (2006) who stated the followings:

“The incremental growth of a budding plant, the natural world is constantly changing form” these observed transformations of size and shape reveal subtle and ordered natural processes that can be seen in both large and small-scale transformation.”

Based on the statements above, it can be understood that the transformation of natural elements has a smooth and orderly process, and each element involved should be studied and evaluated in detail. The criteria selected in the study are as follows:

The elements of forms

Based on Wucius (1995), there are various criteria that feature the elements and principles of design during the analytical process of symbols creation. The researcher has analyzed the process using the element of forms through respondents’ evaluation. Based on the feedback from the respondents and in light of the criteria that have been proposed by Wucius (1995) in the development of design creation, the criteria relevant to the transformation process of symbol design are as follows:

(a) Structure in the process of design
   • Formal and informal structure
   • Structure of merged / separated
(b) Relations in a process design
   • Forms that separate distance
   • Forms that meet and overlap
(c) Repeating the process in the form of design
   • Repeating appearance, size and colour
   • Repeating direction, position and space
(d) Changes gradually form (gradation) in the process of design
   • Changes in appearance and gradual reduction
   • Changes in the gradual change direction and circle
(e) Contrast in the form of process design
   • Contrast in shape and size

The design principles

The criteria in the design principles in the design transformation process are as the followings:

(a) Balanced structure
(b) Flow of line
(c) Form a robust
(d) Simple design
(e) Dominant form
(f) Dominant structural

The transformation flow of sequence

Criteria used at the end of the process flow in the creation and the transformation sequence analysis are as follows:

(a) The orderly movement – Movement format of plots should be added
(b) Movement of creative and development ideas- Movement format of plots should disappear
(c) Movement that meet the criteria
(d) Movement format that is causing the plots is not logical or defects

Based on the above discussion, one can summarize that based on the listed elements and principles of design, this study has identified the most appropriate design criteria that could be applied effectively in the production of plants symbol design. It thus supports the existing criteria suggested by previous researchers. Figure 3 shows the conceptual design framework that relate to the natural processes in the creation process of plants in the design.
Analyzing the growth form of nature

Analyzing process through theory of design, transformation of shapes and form

Basic structure and characteristic of nature form

Basic structure based on principles & elements of design

From seed to plant development and transformation process

Transformation process using forms and shapes towards design

Shaped by natural laws

Design through experimental process, criteria, creativity and manipulation of principles of design

Influenced by earth, wind, fire & water

Influenced by characteristic of design and application of technology

6. Light of human structure - for realizing movement (mouth, hands, etc.)

6. Structure of the elements principles of design – for realizing the process design

Nature Image

Design product

Nature or organic forms relate to natural processes which allow the designer to explore the natural world

Figure 3. Conceptual Design Framework Relating to Natural Processes

IV. FINDINGS

This study gauged the importance of the transformation process in symbol design. Questionnaire surveys were conducted with 159 designs-based students from four universities in Malaysia which are Universiti Putra Malaysia, University of Technology Mara (Shah Alam), University of Technology Mara (Perak) and University Malaya. The followings discuss the respondents’ feedback on the aspects surveyed.

The results on the first stage of the survey indicate that the majority of the respondents (71.3%) agreed to the importance of the design aspects of the transformation process and priority criteria. The respondents feel that it is important to focus on assessing the results of creating good design with appropriate and systematic design criteria in the research field. Results from the second stage of the survey indicate that the average percentage of respondents with a positive feedback on the importance of the subject studied is, 91.6%, while 6.2 % of the respondents did not think that the subject matter is important.

The results indicate that almost all of the respondents agreed that the design criteria for the transformation process is an effective, systematic and easily modified in terms of forms of variations production. The following are the summary of findings on the aspects evaluated by the respondents:

(a) The most important aspect in evaluating tiles design is the process (66.4%) followed by the product (29.2%) while (4.4%) is uncertain.
(b) The most effective technique in analysing the visual process in tiles design is it through the detail (62.8%) followed by the process (37.2%). The results indicate that creativity is an important aspect to assess the various methods in the creation process of ideographic tiles design.
(c) The most influence aspect in identifying the elements in the process of tiles design is the design element and principle (34.6%), followed by the design philosophy and concept (30.0%), culture and environment (27.0%) and designer’s creativity and expertise (8.2%).
(d) The most important criteria in analysing the visual process in tiles design is through the elements and principles of design (59.7%) followed by design creativity and concept (40.3%).

V. INNOVATIONS & COMMERCIALIZATION THROUGH FUNCTIONAL DESIGN

The followings described the potential of the tile design inspired by plant images to be developed as commercial products in the market. The qualities are drawn to the tile design process and the natural potential of plants (flower) in diversifying the design solutions that suit the context.

(a) Statements and Issues: Image of tropical plants represents the identity, way of life of transformations that inspired and last through generations.
(b) Concept of Innovations: The idea was to sustain local elements from local plant images symbols into modern living environment
(c) The Approach: Creating and simplifying a new functional design without losing the beauty and values from the past.
(d) Potential consumer: Local Authority, Local & International Designers, Architects and Planners, Manufacturers, Design Consultants Developers, etc.
(e) Benefits/advantages; Developing a new approach in producing a new tiles images with integration of new concept and material. This measurement will lead to the findings & the similarity of characteristic and function in product innovation and commercialization
(f) Competitors/current practice Designers/ Artist/ Manufactures using the method of tiles design production from actual cultural/local images added directly to product design

Figure 4 indicate the process of design transformation inspired from a flower as nature resource by using the identifiable design and process criteria. The symbolic forms are then transform into product /landscape product eg. tile design (see Figure 5).

VI. CONCLUSION

Discussion in this study can be summarized as follows:
(a) The design can be produced more effectively when the created process explored through the media, equipment, etc. using the proper method.
(b) Emphasis on the visual approach using conceptual sketches produced during problem solving and idea generation process in design. One can express his or her feeling and emotions during the process and eventually produce more innovative artistic expression and meaning.
(c) The approach includes the intellectual process of forming goals and boundaries, analysing the situation, taking into account the existing possibilities, selecting elements for analysis and creating a way to approach the appropriate design problems of design.

The needs of systematic thinking ability and a clear goal are important in producing an effective transformation process. Beauty, harmony and aesthetic values must be taken into account in the visual assessment. The studies on the transformation process and methods based on the nature and the Islamic concept, in particular the plants and Islamic elements can contribute in increasing the knowledge and the production involving product design that based on the nature as resources. In addition, the theoretical information that has been collected and practice in this study can be utilized to create innovations and their promotion for nature based product

The use of local plants could generate the original identity of symbols and images to industrial as well as architectural and landscape products. By exposing the systematic methods, techniques and processes through experimentation, innovation and Islamic knowledge contribution could be used to benefit the related parties. Indirectly, it encourages Muslim inventors and designers to increase the number of products and production of various product designs.

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Elderly Empowerment through Local Potential Based On Islamic Boarding School
(A Study at the Al Mahalli Elderly Islamic Boarding School, Yogyakarta Indonesia)¹

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Abstract - Life expectancy age of people in the world is getting longer up so the number of elderly is more than the growth of birthrate. Therefore, many countries including Indonesia began focusing attention to the lives of the elderly. A variety of programs to improve the well-being of the elderly has been pursued by the government, but the problems around elderly are still various, so many parties need to help the government to develop variety innovative efforts to improve the well-being of the elderly. For this reason, this study was conducted to make the elderly empowerment model through Al Mahalli Islamic Boarding School with local potential utilization of human resources as well as its natural resources. Through qualitative methods, data collection involved managers, officials, and the elderly around the Islamic Boarding School to explore the problems and needs of the elderly then be used as material to make a local potential based empowerment model. Research results formulate a model that is focused on two things: the natural potential and human resource potential that begins with look, think, act, monitoring and evaluation steps resulting in physical and spiritual well-being of the elderly.

Index Terms- elderly empowerment, local potential, natural resources potential, human resource potential

I. INTRODUCTION

1.1 Background of the study

Along with advanced technological, especially in the fields of health, human life expectancy is getting longer. It means that there are more elderly people. Elderly are people aged 60 years and over. Entering the 21st century, the number of elderly in the world has reached nearly half a billion people. Even later projected in 2025 it is amounted to 1.2 billion people. Each month, people who passed the threshold of 60 years reach almost one million people. It is also reported in the United States that the increase of elderly reached 1000 people and an estimated 50% of the population over the age of 50 years in 1985 (Adib, 2008).

In Indonesia, the number of elderly in 1990 has reached 11.4 million, and in 2000 that number increased to 22.2 million, and then projected in 2020 the number reached 29 million people (Adib, 2008). Statistic data shows that in 1971 the elderly in Indonesia amounted to 5.31 million people or only about 4.48 percent of the total population of Indonesia. In 1980 the number is amounted to 7.9 million (5.5%), and in 1990 increased to 11.3 million (6.3%), 14.4 million (7.18%) in 2000, and 19 million elderly (8.9%) in 2006. Statistic data in 2013 showed that the number of elderly is currently 25 million of the 240 million people in Indonesia.

The data indicates that the number of elderly people is greater; so many experts predict that there will be changes in the structure of the state as the number of elderly is greater than the birth rate. As a matter of fact, the government actually has realized the importance of giving attention to the lives of the elderly. Moreover, it is reported that Indonesia elderly have not been fully prosperous as stated by Tuti Heryati, The Director of Social and Elderly Services on a dialogue on Pro RRI at Social Institutions Tresna Wredha Budhi Dharma in Bekasi on Monday, March 4, 2013 which are presented in the online news of RRI on 4th March 2013.

Efforts to tackle the elderly in Indonesia by the government have already been good enough for example to coordinate the presence of elderly integrated health posts in every village. These posts provide services for elderly such as the provision of nutritional health checks, free medical care, and health education. In addition, the government also makes the Elderly Social Security Program (JSLU-Jaminan Sosial Lanjut Usia). The main objective of Elderly Social Security Program is to ease the burden of fulfilling the basic needs and the continuance of the elderly as well as maintaining elderly social welfare so they can enjoy a reasonable, peaceful, and prosperous standard of living. JSLU funds are funds given by the government to provide

¹ This article had been presented in International Conference of Organizational Innovation (ICOI) 11-14 August 2014 in De La Salle University Philippine
welfare to the abandoned elderly. Currently, Ministry of Social Affairs through the Directorate of Social Services and
Rehabilitation is only able to reach 10 thousand elderly of 1,644,002 inhabitants or 8.2 % of abandoned elderly in Indonesia
through JSLU. Statistic data of 2008 mentions elderly population as much as 19.5 million people, of that number there were
1,644,002 people or about 8.2 % are abandoned elderly and in poor condition (data of Pusdatin 2008 in the Directorate of Social
Rehabilitation News Online 10 February 2010).

The government’s extraordinary attentions since 2010 should have been able to make the elderly’s lives better, now.
However, in reality, not all of elderly are at prosperous lives. There are many elderly people who live in poverty, suffer
sickness, do not have families who love and care for his/her even become a trouble maker who commit immoral acts and
criminality. As reported by Redaksiana on Trans 7 on 12 March 2014 at 15:00, there was an elderly (89 –years old) who was
jailed for being a croupier. At the show, it was also reported that a 75 -years old grandfather was beaten by the masses after
proven stealing panties of women in the village. After investigation, it is obvious that the grandfather likes to watch porn, which
made him do this such an inappropriate behavior to vent his lust. In addition, Reuters online news on February 3, 2014 mentions
an elderly patient named Supaman (64 years old) expelled from an ambulance in Sukadanaham, Tanjungkarang West Lampung
on 21 January. Residents, who found that elderly patient, immediately took him to the Public Hospital Dadi Tjokrodipo Bandar
Lampung.

These cases demonstrate that the government's efforts in dealing with the elderly have not been completed and needs
the support of all parties. Elderly need to be understood individually because each individual is different (individual
differences). The more the number of elderly, the more complex the problems and needs of the elderly as well. Therefore, it
is necessary and very important to do the research in order to understand more fully the elderly. Moreover, because in fact that
old age is not only seen from the chronological age of those who were aged 60 years and over, but those who have retired (56
years) most already consider themselves to be helpless elderly, need attention, no longer productive, and feel diminished. Thus,
the problems of the elderly in Indonesia, which needs attention of all parties, are more complex.

Based to those statements, the Al Mahalli Islamic Boarding School in Brajan Wonokromo Bantul Yogyakarta expands
its attention on the well-being of the elderly by establishing Islamic Boarding School for Elderly in Mojolegi Village Imogiri
Bantul Yogyakarta. This innovative Islamic Boarding School was built on a land area of 4000 m² and started its activities on 2
March 2014 ago. Their first event was attended by more than 600 elderly (interview with a caregiver and manager of Al Mahalli
Elderly Islamic Boarding School). The presence of this elderly activity center has been long awaited by the people around the
Islamic Boarding School. To optimize this boarding’s programs to be more beneficial and sustainable, therefore, it is necessary
to analyze the needs of the elderly and the potentials that can be developed in Islamic Boarding School and its surrounding
areas.

Researches on the elderly are not too many; therefore, it still needs to be developed as an expression of many universities’
concerns to social problems. Several studies which have been conducted on the elderly mostly focus on understanding the
-cultural aspects of life of the elderly in making the decision of choosing a place to stay, as was done by Adib (2012) and
Suardiman and Iswanti (2008). In addition to culture, other researches on elderly focus on religiosity of elderly as was
done by Icha (2004) about Elderly Care Fellowship at the Evangelical Church in Minahasa and Machasin (2013) that examined
elderly’s religiosity. Of the few studies which have been done, it has not been found any research on elderly empowerment
models although government programs towards improving the welfare of the elderly are already exists.

The study, entitled “Empowering the Elderly through Local-Potential-Based at Islamic Boarding School”, is also
different from previous empowerment research. So far, there are more empowerment research on the women empowerment
(Latu, Mast, Lammers, & Bombari, 2013; Astuti, 2012), patient empowerment (Subandi, 2010), empowerment of employees or
marginal men in the company (Asgarsani, Duostdar, & Rostami, 2013, Fernandez & Moldogaziev, 2013 ; Prati & Zani, 2013),
and empowerment of the poor (Astuti, 2012), but this study focused on the analysis of the elderly’s self-potential and the
potential of the elderly’s living environments that allow the elderly to be developed mutually with an Islamic Boarding School
as the prime mover in order to reach balance between physical and spiritual prosperity. The research was conducted in
Yogyakarta, a province that has the largest number of elderly in Indonesia, which is 12.5 % of its population are elderly
(Suardiman & Iswanti, 2008). In addition, the determination of Imogiri Bantul as the location of the study because Bantul
was selected as a pilot city of elderly empowerment in national level (Bantul News Online, January 13, 2014 10:26 pm).

Empowerment at its core is to empower someone to be more progressive and independent (Kartasasmita, 1997) in the
other word is to empower someone to be prosperous. Innovation of this study lies in the subject of the research. So far ,
most studies focus on the empowerment at productive age, but this study focused on the elderly because in fact there are many elderly
who require an affiliation place that makes them better phisically and spiritually. Phisical welfare means to obtain the
opportunity and capability to get the rights essence as a human being: for example to fulfill food needs and clothing, to get
adequate basic education, and health. For spiritual welfare i s to be happy, respected and valued, free from fear, free from
threats, free to give an opinion, and can participate in community life. Every man is entitled to the welfare, including the
elderly; therefore, it is very accurate if this study was conducted in an effort to support the government's programs to promote
welfare of Indonesia elderly. If Indonesian elderly are welfare, then the impact of the research results of this action will support
the Master Plan Program for Acceleration and Expansion of Indonesian Economic Development (MP3EI), which is an initial
step to encourage Indonesia to be developed and included ten (10) countries in the world by 2025 through high economic
growth which is inclusive equitable and sustainable (Astuti, 2012).

1.2 Formulation of the problems
Formulations of the problems in this research are:

a. What are the needs of elderly in Al Mahalli Islamic Boarding School?
b. What are potential resources (natural and human resources) owned by Mojolegi community?
c. How is the appropriate elderly empowerment model to improve welfares of elderly who has joint in the Islamic Boarding School?

1.3 Purpose of the study

The purpose of this study is to determine the needs of the elderly and the potential resources in order to formulate a local-potential-based empowerment model that can be used by an Islamic Boarding School to improve the welfare of the elderly who join in Islamic Boarding School.

1.4 Benefits of the study

Benefits of this study are as follow:

a. To get the elderly empowerment model which is based on local potential as reference material for Elderly Islamic Boarding School Al Mahalli to formulate activities held by Islamic Boarding School. It is very important so that the activities developed in Islamic Boarding School have value and receive a positive response from elderly people.

b. by means of forming relationships to elderly homes during assessments, to open the harmonious relationship between the Islamic Boarding School and community that undermine the impression of Islamic Boarding Schools like the ivory tower which is not in harmony with local people

c. Improve understanding of the elderly boarding manager to the needs of the elderly so that the manager can adjust to the elderly people who become the target of the Islamic Boarding School.

d. Provide added value to the community, especially the elderly who joined the Islamic Boarding School.

II. REVIEW OF LITERATURE

2.1 Elderly

Elderly is a whole process that is characterized by the occurrence of physical and spiritual changes slowly and gradually so-called senescence that is the process of becoming old and senility (suffer from weakness) if there has been a particularly physical deterioration of the lining of the brain will affect his mental state (mental disorganization) (Indati, 2013). Although not many researchers are interested in studying the elderly, at least it has been found some research on the elderly which has been done by several previous researchers. Some of them are as follows. Icha (2004) examined the typical elderly spiritual care in Minahasa culture, with the title Elderly Care Fellowship at the Evangelical Church in Minahasa. This study raised the need for Minahasa elderly and Christian education curriculum in the church. Tamher (2009) examined the health of elderly with nursing care approach, the Ministry of Health research team in 2012 researched curriculum and training modules for the elderly and geriatric for clinic staff, Adib (2012) conducted a study of the elderly in urban areas under the title Live Together with Family is More Comfortable. Adib research proves that 56% of elderly respondents chose the living in their own homes, and 42% were residing with family (children and grandchildren). There is no respondent ever wanted to reside in elderly nursing homes. Suardiman and Iswanti (2008) examined the phenomenon of elderly living at children’s houses (Studies in Cultural Java).

2.2 Empowerment

Empowerment is often associated with female (Latu, Mast, Lammers, & Bombari, 2013; Astuti, 2012), patients (Subandi, 2010), employees or marginal man in companies (Asgarsani, Duostdar, & Rostami, 2013, Fernandez & Moldogaziev, 2013; Prati & Zani, 2013), and the poor (Astuti, 2012). Astuti (2012) who examined the poor women stated that the factors that influence poor women in the utilization of local resources among other factors that come from within themselves such as get low education (77% graduated or un-graduated from elementary school), have no skills other than farming and the factors that come from outside themselves such as they do not have access to poverty alleviation programs from the government or the local government. Fernandez and Moldogaziev (2013) stated that the practice of employee empowerment has been done in private and state agencies in the past 30 years. Empowerment of employees was committed in order to improve job satisfaction, organizational commitment, innovation, and performance.

To explain the patient empowerment, Subandi (2010) proposed the consumers term to replace the patients term, especially patients with mental disorders. Consumer empowerment movement is not only engaged in practice, but also tried to change scientific theories about mental disorders, especially the pessimistic view that schizophrenia is incurable.

Women, patients, employees, and the poor are included in the category of marginalized groups or those who are not important. Elderly is included in this group because in this period there is a decrease in his/her physical function resulting in feelings that is not as strong as his/her youth, there is no one who pay attention and listen to the elderly so they are considered to have limitations (Indati, 2013). This statement refers to Rahman (2006) who states that marginal groups are those who are extremely poor, elderly, homeless, less education, and have no skills. Because the elderly are considered marginal, therefore the elderly empowerment should have been done.

Empowerment comes from the word “power” which get the affix em- to be the word "empower" which means to have power. Power means strength, empower means to have strength. Empowerment means being able to do something or have power or strength. Empowerment in Indonesia is a translation of empowerment in the English language. The meaning of empowerment by the government is encouraging the community to work independently, with the aim to improve the measurements of physical and non-physical in society life. The meaning of empowerment by enterprises is an effort to improve welfare of the community who want to live on welfare, with absolute and relative measurement, so there is a mutually beneficial relationship between communities and enterprises. While the meaning of empowerment by NGO is an effort to increase the
community's ability to know and meet their real need, with effort and ability of the community itself, through economic, social and cultural indicators (Yunani, 2012).

Talking about empowerment means talking about what is empowered. Therefore, the first step that needs to be understood is to know the needs of the society or communities that are empowered. Empowerment raises the inspiration and motivation of community members to contribute significantly to the organization and have the confidence that their contributions would be appreciated, so they feel that their lives are useful and meaningful. Larkin et al. (2008) stated that psychological empowerment includes feelings of capable, independent, have valuable work, and can contribute to each other. Empowerment makes a change in behavior and social structure. Community empowerment is highly dependent on the environmental potential of each community will be empowered, while individual empowerment depends on the potential of each individual. The task of the facilitator is to help them to discover their potentials, form, and lay out the steps.

Empowerment theories consist of process theory and outcome theory (Parkins & Zimmerman, 1995). According to Zimmerman (2000), the theory of the process of empowerment at individual level look at how people learn and seek to achieve their objectives, while at the community level see how the growing awareness and community participation to jointly utilize the resources in order to have more value. The outcome theory is measured by the achievement of indicators which is developed by Das and Bhowal (2013) that the emergence of self-confidence, willingness to participate in various activities, contribution to increase the family income, benefit of existing resources, freedom of mobility, role in decision making, and increasing the role of the various groups and meetings.

Elderly have needs as individuals in general (Indati, 2013), namely basic needs, psychological, social, and spiritual. Basic human needs include food, clothing, shelter, health, and education. Psychological needs include the need for mental functioning such as memory, learning and intelligence, capacity adjustment, and personality. Social needs include the need for the recognition of the existence of the individual in existence with others. Spiritual needs include the philosophy of life, peace of life, the meaning of life, purpose of life, the spirit of life in the elderly and how their faith shown when facing trials in elderly life (Mujiadi, 2012). These needs are what to be explored through this research.

In order to be successful empowerment program, various experts have developed a model of empowerment. Empowerment models adapted to the problems of the community or individuals who are empowered. Among the various existing models of empowerment, this study refers to the empowerment model that has been developed by Astuti (2012) for a more comprehensive to explain the process from preparation to evaluation and better suited for this research.

Astuti empowerment model (2012) includes several stages.

a. Preparation stage or Look and Think Stage, includes preparation for administration and preparation for the field study site. The administration includes the design and preparation stages of research, licensing and initial contact with the various parties that will be involved in research. For site preparation, some activities have been done including initial assessment to map the research subjects as well as stakeholders to be involved. At this stage it is also analyzed the potential needs and resources system which are available at the sites. Through this activity, it was obtained the data of research subjects, as well as discussion about the problems, needs and plans of action to be performed. To ensure the condition of the target research, it was also carried out home visit for triangulation with field conditions in order to obtain information regarding local resources that can be utilized.

b. Phase Act, that is entrepreneurial guidance, skills counseling, social assistance by a team of local facilitators, and inter-institutions program synchronization process to support economic acceleration, through the development of technologies to be utilized by the target group, especially in the Elderly Islamic Boarding School Al Mahalli.

c. Monitoring and Evaluation, In this phase of the evaluation and monitoring of the activities carried out in the form of a discussion group at the local community level that is representative of elderly who joined in elderly Islamic Boarding School Al Mahalli, caregivers, and managers.

III. RESEARCH METHODOLOGY

3.1 Field of the Study

This research is included field study took place in Al Mahalli Elderly Islamic Boarding School in Mojolegi Village Imogiri Bantul, Yogyakarta. Al Mahalli Elderly Islamic Boarding School is a development of the existing Al Mahalli Islamic Boarding School in Brajan Wonokromo in Bantul. Al Mahalli Islamic Boarding School Brajan focus on school children from elementary school age through college, while the Al Mahalli Islamic Boarding School in Mojolegi Imogiri focus on older students (elderly). Al Mahalli elderly Islamic Boarding School currently is still in the form of the pavilion as a center of elderly activities but had been planned to be built hostel for the elderly who want to stay at the Islamic Boarding School.

Seeing the extraordinary enthusiasm of the citizens and government officials around boarding makes the managers eager to design appropriate programs so that the Islamic Boarding School can achieve successful development. Mujahadah as the inaugural event was held in the pavilion on March 2, 2014 was attended by more than 600 people. These conditions stimulate the boarding manager to formulate appropriate programs to accommodate potential elderly who joined at the Islamic Boarding School and potential boarding environment. For that reason, we need a series of scientific effort to examine what elderly needs and what potential can be developed to empower the elderly through boarding.

To answer these questions, this study involved respondents consisting of elderly who were around Islamic Boarding School, Islamic Boarding School managers, and local officials. The collection of the data is in the form of interviews with the respondents and observation of the elderly activities which are managed by Islamic Boarding School. The analysis of the data used in this study is descriptive, which describes an overview of the scope of activities of the Islamic Boarding School and its local potentials that can be developed by this Islamic Boarding School. In this research, empowering the elderly will be on two
things, namely the elderly community empowerment by utilizing the environmental potential namely natural resources and individual empowerment to assist the elderly who want to actualize themselves in order to feel valued for being able to contribute to society according to their potentials.

3.2 Data Collection
The implementation of this research study begins with interviews with caregivers and managers of Al Mahalli Elderly Islamic Boarding School, interviews with the elderly in the Mojolegi village, and local officials then later observation to see the daily lives of the elderly and observing resources that can be developed. After that, to complete the preparation of boarding program materials, FGD (Focused Group Discussion) is needed by presenting representative of elderly, managers, and experts (psychologist and the National Commission for the Elderly). The next step is to map and analyze the data, and make conclusions.

IV. RESULTS AND DISCUSSION
The data has been obtained is the data about the condition of the area of Islamic Boarding School and a glimpse portrait of Mojolegi village residents which are obtained from interviews with caregivers, elderly, and managers. From the interviews with caregivers of Al Mahalli Elderly Islamic Boarding School on March 1, 2014, it is obtained a picture that elderly boarding is planned to build dormitories for grandfathers and grandmothers. Not all elderly who studied at the Islamic Boarding School of Al Mahalli must live in Islamic Boarding School because this Islamic Boarding School will accommodate activities of elderly community that have joined the boarding although not stay at the Islamic Boarding School. Interview with Mr. X, one of the elderly who live near the Islamic Boarding School on March 4, explained that the local community is very excited about the establishment of elderly Islamic Boarding School in the area which are proved by Mujahadah as inaugural event of elderly Islamic Boarding School on March 2, 2014 ago. At that events, about 500s people, most of them are people of Mojolegi, came. This Islamic Boarding School is supported by the village chief and his staffs.

The interviews with the caregiver of Islamic Boarding School dated March 11, 2014, explained that previously opinion of the public outside the Mojolegi community was unfavorable because the village was occupied by the former scavengers and beggars who were organized. That's why 15 years ago, the caregiver of the Islamic Boarding School dreamed of getting Mojolegi society as a respectable village. Unfortunately, the boarding’ primary caregiver, namely KH Mudjab Mahalli, who has had a Islamic Boarding School in Bantul Wonokromo Brajan passed away before realizing his dream. Now, his wife in this year determined to realize his dream. This very noble dream would require the support of various parties so that researchers raised this issue to help them realizing these goals whilst supporting government programs to improve the welfare of the elderly.

The results of the problems and needs analysis show that the elderly around the Islamic Boarding School need a place for their activities in order to make them more meaningful. They want these Islamic Boarding School can accommodate their religious activities toward closeness to the Creator as well as accommodate them performing various activities that they enjoy so that they feel happy and prosperous in their elderly age. In addition, because the elderly daily tasks at home is "momong wayah" (caring for grandchildren), then they want to have children religious study activities so that they can still meet their grandchildren at the Al Mahalli Islamic Boarding School.

If it is observed from its natural condition, Mojolegi village where Al Mahalli elderly Islamic Boarding School was established is a fertile village located in the Imogiri hills adjacent to the Tomb of the Kings of Yogyakarta. The environment is clean and organized quite neatly. Even in the village is located the Bukit Hijau (Green Hill), a beautiful site. Unfortunately, this beautiful site is not well known so its natural potential is yet widely known. Commonly the resident has a passion fruit plants in their gardens. Actually training to process passion fruit syrup is ever gotten, however less extensive marketing so they just make syrup when there are orders only. Most other elderly make brooms, nuts processing products, and cashew peeling. As passion fruit syrup, marketing of broom, nuts products, and cashew is less extensive that need boarding’s attempts to open opportunities for cooperation with various parties for marketing and product innovation through entrepreneurship mentoring. In this village also grow teak trees which are usually not old enough but they were already sold to furniture and sills makers. If the age of teak trees is extended, the likely result will be more profitable. Therefore, an understanding of this matter needs to be given to residents.

If it is observed from the street and houses, which are a clean and neat, it seems that there are role model figures who are reliable as activators. This potential human resources should be empowered so that they feel valued and find meaningful life. Therefore, it is necessary for Islamic Boarding School to look at the potential of these human resources so that their presence adds to the proliferation Islamic Boarding School empowerment activities.

Based on observation and interview, the elderly empowerment model for Elderly Islamic Boarding School Al-Mahalli can be formulated as follows.
Figure 1. Elderly empowerment model through local potential based on Islamic Boarding School

The picture explains that the problems which are faced by the elderly around Islamic Boarding School Al Mahalli are the obstacle in natural resource processing. Natural resources can be utilized and developed in Mojolegi village are woods, cashew, peanut, and passion fruit. What are expected by the elderly is to get an explanation about entrepreneurship because this research is based on local potential development and open up opportunities for cooperation with various parties to improve the production and marketing of local products.

Problems of elderly lies in the fact that so far their daily activities are caring for their grandchildren, therefore the elderly need to be equipped with parenting education to the generation of different times so that they are more skilled in preparing the next generation to be expected. In addition, because 100% of Mojolegi citizens are Muslims, then it is appropriate if Islamic Boarding Schools are responsible for providing religious development activities regarding the tremendous enthusiasm of elderly when boarding’s inaugural recitation activities was held in early March 2014 ago.

V. CONCLUSIONS

From data above, it can be conclude that the elderly around the Islamic Boarding School need a place for their activities in order to make them more meaningful. They want these Islamic Boarding School can accommodate their religious activities toward closeness to the Creator as well as accommodate them performing various activities that they enjoy so that they feel happy and prosperous in their elderly age.

For the potential resources (human resources) from the street and houses, which are a clean and neat, it seems that there are role model figures who are reliable as activators. This potential human resources should be empowered so that they feel valued and find meaningful life.

For the potential resources (natural), commonly the resident has a passion fruit plants in their gardens. Actually training to process passion fruit syrup is ever gotten, however less extensive marketing so they just make syrup when there are orders only. Most other elderly make brooms, nuts processing products, and cashew peeling to open opportunities for cooperation with various parties for marketing and product innovation through entrepreneurship mentoring. In this village also grow teak trees which are usually not old enough but they were already sold to furniture and sills makers.

The elderly expected is to get an explanation about entrepreneurship to open up opportunities for cooperation with various parties to improve the production and marketing of local products. In addition, 100% of Mojolegi citizens are Muslims, it is appropriate if Islamic Boarding Schools are responsible for providing religious development activities.

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A Study of Brand Equity and Marketing Mix Constructs Scale Invariance in UAE

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Abstract- The purpose of this research is to test measurement invariance, of previously developed scales, to evaluate brand equity and marketing mix constructs in the United Arab Emirates (UAE) consumer market. A total of 10 constructs are considered for the study. Five of which are brand equity constructs of Brand Awareness, Brand Loyalty, Perceived Quality and Brand Associations with Overall Brand Equity (OBE) and five marketing mix elements – Price, Distribution Intensity, Advertising, Price Promotions and Non-price promotions. Scales from previous studies are selected and a questionnaire developed to collect data. Data was collected for 359 consumers across age and gender among the English speaking expatriate population. Lisrel 8.8 and SPSS is used to test construct reliability. The findings of this research are that the scales developed in previous studies are invariant in the UAE. They show good reliability and validity. These scales can be used in brand equity studies involving English speaking consumers in the region.

Index Terms- Brand equity, Marketing Mix Elements, FMCG, UAE, Structural Equation Modeling, Brand Awareness, Brand Loyalty, Perceived Quality, Brand Associations

I. INTRODUCTION

Brand equity (BE) is a key concept in brand management. Its definition and management is a subject of various books, articles and research. Its importance stems from providing valuation to a brand. The valuation of a brand can be done in financial terms and consumer perspective. The consumer based brand equity (CBBE) is reflected in the financial brand equity. The stronger the CBBE – the higher will be the financial value of the brand. Consumer based brand equity is a multidimensional concept comprising of various constructs – prominent among them being brand loyalty, perceived quality, brand awareness and brand association (Aaker 1991). The brand equity dimensions in turn are functions of marketing mix – product, price, promotions and placement. Brand equity models have been conceptualized by leading brand thinkers, prominent among them are Aaker’s brand equity model (1991). Conceptual models have to be operationalized so as to have practical use. Yoo (2000) first operationalized the model followed by verification studies in other cultures and categories with varying results.

Operationalization studies have been carried out in various countries and scales developed to measure the various constructs. The purpose of this study is to test the scales, which have been developed in previous studies and their invariance in measuring constructs in UAE. Previous researches have recommended that the scales be tested in various countries and categories for invariance. This study follows from that recommendation.

II. LITERATURE REVIEW

Brand equity measurement scales

Brand equity can be deconstructed into various dimensions which in turn are impacted by various marketing activities – these have been hypothesized in various brand equity development models (Aaker 1991, Keller 1993, Kapferer 1994). In a detailed literature review, a total of 11 key brand dimensions have been identified. They are perceived quality, Brand Associations, brand Loyalty, brand awareness, brand Image, brand personality, attitude, trust, satisfaction, esteem and attachment. Various models have been hypothesized with marketing mix elements being the independent variables, which impact the brand equity dimensions creating an overall brand equity. Some of the models have been operationalized and scales developed to measure the constructs (Yoo 1997, 2000, 2001, Pappu 2006, Buil 2008).

Aaker (1993) notes that “there is a need for brand equity measures that can be used to evaluate the brand-building activities of managers in different product markets” he goes on to say “The challenge for many brands is to develop credible and sensitive measures of brand strength that supplement financial measures with brand asset measures.

There are two basic approaches to measuring customer based brand equity. The "indirect" approach attempts to assess potential sources of customer-based brand equity by measuring brand knowledge (i.e., brand awareness and brand image). The "direct"
approach attempts to measure customer-based brand equity more directly by assessing the impact of brand knowledge on consumer response to different elements of the firm's marketing program. The indirect and direct approaches to measuring customer-based brand equity are complementary and should be used together (Keller, 1993).

Lassar et al (1993) were among the first to work on developing scales to measure brand equity. They operationalized brand equity as “the enhancement in the perceived utility and desirability a brand name confers on a product”. It is the consumers’ perception of the overall superiority of a product carrying that brand name when compared to other brands. The scales measured 5 constructs of performance, social image, value, trustworthiness and attachment. The scales were developed after four studies in which the initial scale of 83 items were narrowed to 17. The resulting scale was significantly correlated with an overall measure of brand equity. The scale was tested in two product categories where it was found that prices reflected the equity associated with the brand.

Yoo (1997, 2001) in a first of is kind study on brand equity explores the relationships between selected marketing mix elements and the creation of brand equity. They proposed a conceptual framework in which marketing elements are related to the dimensions of brand equity, that is, perceived quality, brand loyalty, and brand associations combined with brand awareness. These dimensions are then related to brand equity. The empirical tests using a structural equation model support the research hypotheses. The results show that frequent price promotions, such as price deals, are related to low brand equity, whereas high advertising spending, high price, good store image, and high distribution intensity are related to high brand equity. A 34 item measurement scale was developed, of which 4 items were to measure overall brand equity, 19 to measure the brand equity dimensions and 15 to measure the marketing mix constructs.

Washburn (2002) working on the scales proposed by Yoo & Donthu (1997, 2001) – tested a total of 7 constructs – MBE (4), OBE (1) and two constructs measuring attitude toward the brand and purchase intention slightly modified and in a different context to examine the robustness of the scale. The results of the ten-item, three-factor MBE model are most consistent with Yoo and Donthu’s (1997) findings. The researchers were able to improve the model using Yoo and Donthu’s (1997) same three-factor structure but by examining all 15 items rather than the ten item ultimately used by Yoo and Donthu (1997). The analysis also found acceptable fits, with acceptable composite reliability and variance extracted, for a four-factor MBE model, again starting with 15 items. In situations where a four-factor analysis is imperative, it is recommended that is be used with caution. This model should be used with even closer attention paid to fit and residuals. The results of this research provide some support for Yoo and Donthu’s (1997) OBE model and three-factor MBE models. Nonetheless, the support is inadequate to offer an unconditional endorsement of Yoo and Donthu’s (1997) brand equity measures.

Buil (2008), developed and tested a 6 construct model to study the measurement invariance of the consumer-based brand equity scale across two samples of UK and Spanish consumers. Their findings were that the brand equity scale was invariant across the two countries. The Results showed that the consumer-based brand equity scale has similar dimensionality and factor structure across countries. In addition, consumers responded to the items of brand equity in the same way, which allows meaningful comparison of scores.

Tong (2009) explored the effectiveness of eight selected marketing activities in creating brand equity in the Chinese clothing market. The results indicate the positive effects of store image, celebrity endorsement, event sponsorship, web advertising, and non-price promotions on brand equity in China as well as the detrimental impact of frequent price promotions. A 20 items scale was used to measure the constructs.

A total of 10 constructs were identified for this study – 5 endogenous being Brand Equity, Brand Awareness, Brand Loyalty, Perceived Quality and Brand Associations and 5 exogenous and independent constructs namely Price, Distribution Intensity, Advertising, Price Promotions and Non-Price Promotions that will be measured. A total of 33 measurement items were identified for the study. The scales used were initially developed by Yoo and Donthu (2000, 2001) and subsequently used in as is or adapted by Rajh (2005), Atilgan (2005), Pappu (2005), Yasin (2007), Buil (2008), Tong (2009). Refer to Table 1 for a summary.

**Multi-Item Scale Evaluation**

A construct is an unobservable or latent concept that the researcher can define in conceptual terms but cannot be directly measured or measured without error. It is defined in varying degrees of specificity, ranging from quite narrow concepts to more complex or abstract concepts, such as intelligence or emotions. No matter what its level of specificity, however, a construct cannot be measured directly and perfectly but must be approximately measured by multiple indicators. Operationalization a construct refers to selecting its measurement scale items which can either be taken from previous research or developed by the researcher (Hair, 2006). A measurement scale is used to evaluate a construct, which is a multi-item scale as there are multiple indicators to evaluate the constructs.

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A multi-item scale needs to be evaluated for accuracy and applicability which is done through an assessment of reliability, validity, and dimensionality of the scale (Hair, 2006; Malhotra, 2007).

Reliability

Reliability is an assessment of the degree of consistency between multiple measurements of a variable (Hair, 2006). It refers to the extent to which a scale produces consistent results if repeated measurements are made. Reliability is assessed by determining the proportion of systematic variation in a scale which is done by determining the scores obtained from different administrations of the scale. If the association is high, the scale yields consistent results and is therefore reliable. Of the three approaches for assessing reliability (test-retest, alternative-forms and internal consistency methods) we will take the internal consistency approach. Internal consistency reliability is used to assess the reliability of a summated scale where several items are summed to form a total score. In a scale of this type, each item measures some aspect of the construct measured by the entire scale, and the items should be consistent in what they indicate about the characteristic. This measure focuses on the internal consistency of the set of items forming the scale. The coefficient alpha or Cronabach’s alpha will be used to test the internal consistency reliability (Malhotra, 2007).

Reliability coefficient with Cronbach’s Alpha – generally agreed lower limit is .70 although it may decrease to .60 in exploratory research. A value of 0.6 or less generally indicates unsatisfactory internal consistency reliability (Hair, 2006).

Validity

Validity is the extent to a scale or a set of measures accurately represents the concept of interest (Hair, 2006). The validity of a scale may be defined as the extent to which differences in observed scale scores reflect true differences among objects on the characteristic being measured, rather than systematic or random error (Malhotra, 2007). Content validity and construct validity are what will be assessed here.

Content validity is the assessment of the correspondence of the variables to be included in a summated scale and its conceptual definition. This form of validity, also known as face validity, subjectively assesses the correspondence between the individual items and the concept through ratings by expert judges, pretests with multiple sub-populations, or other means. The objective is to ensure that the selection of scale items extends past just empirical issues to also include theoretical and practical considerations (Hair 2006). It is a subjective but systematic evaluation of how well the content of a scale represents the measurement task at hand where the researcher or someone else examines whether the scale items adequately cover the domain of the construct being measured (Malhotra, 2007).

Scales selected for this study were adapted from previous studies, they were also run by marketing professionals and consumers for assessment.

Construct validity addresses the question of what construct or characteristic the scale is measuring where the researcher attempts to answer theoretical questions about why the scale works and what deductions can be made concerning the underlying theory which therefore requires a sound theory of the nature of constructs being measured and how it relates to other constructs (Malhotra, 2007).

Construct validity is the extent to which a set of measured items actually reflects the theoretical latent construct those items are designed to measure. Thus, it deals with the accuracy of measurement. Evidence of construct validity provides confidence that item measurers taken from a sample represent the actual true score that exists in the population (Hair, 2006).

A. Convergent validity

Convergent validity assesses the degree to which two measures of the same concept are correlated. Here the researcher may look for alternatives measures of a concept and then correlate them with the summated scale. High correlations here indicate that the scale is measuring its intended concept (Hair, 2006). Convergent validity is the extent to which the scale correlates positively with other measures of the same construct (Malhotra, 2007).
Table I: Summary of Scales Tested Across Studies

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<td>Store image</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7639  www.ijsrp.org
<table>
<thead>
<tr>
<th>Distribution intensity</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising spending</td>
<td>3</td>
</tr>
<tr>
<td>Price deals</td>
<td>3</td>
</tr>
</tbody>
</table>
CFA provides a range of information to evaluate convergent validity – Maximum likelihood factor loading estimates and their associated t-values to be evaluated. Loadings should be at least .5 and preferably .7, variance-extracted measures should equal or exceed 50% while .70 is considered the threshold for reliability of a construct (Hair, 2006).

B. Discriminant validity
Discriminant validity is the degree to which two conceptually similar concepts are distinct. The empirical test is again the correlation among measures, but this time the summed scale is correlated with a similar, but conceptually distinct measure. Now the correlation should be low, demonstrating the summed scale is sufficiently different from other similar concept (Hair, 2006). Discriminant validity is the extent to which a measure does not correlate with other constructs from which it is supposed to differ which involves demonstrating a lack of correlation among differing constructs (Malhotra, 2007). The conservative approach for establishing discriminant validity compares the variance-extracted estimates for each factor with the squared interconstruct correlations associated with that factor which should be greater implying that are no problems with discriminant validity (Hair, 2006).

C. Nomological validity
Nomological validity refers to the degree that the summed scale makes accurate predictions of other concepts in a theoretically based model. The researcher must identify theoretically supported relationships from prior research and then assess whether the scale has corresponding relationships. (Hair 2006). Nomological validity assesses the relationship between theoretical constructs where it seeks to confirm significant correlations between the constructs as predicted by theory. (Malhotra, 2007). The correlation matrix in EFA to analyze the extent to which the constructs are related to one another.

Unidimensionality
Unidimensionality implies that all the items in a scale are strongly associated with each other and represent a single concept. Factor analysis plays a pivotal role in making an empirical assessment of the dimensionality of a set of items by determining the number of factors and the loadings of each variable on the factor(s). The test of unidimensionality is that each summed scale should consist of items loading highly on a single factor. All cross loadings are hypothesized to be 0 when unidimensional constructs exist. Covariance among error terms of two measured variables should also be evaluated. Significant between-construct error covariances suggest that the two items associated with these error terms are more highly related to each other than the original measurement model predicted implying significant cross-loading exist. Unidimensionality can be assessed by exploratory factor analysis or confirmatory factor analysis (Hair, 2006)

Factor analysis provides the researcher with an empirical assessment of the inter-relationships among variables, essential in forming the conceptual and empirical foundation of a summed scale assessment of content validity and scale dimensionality.

Table II summarises the information.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measure Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability (Internal Consistency)</td>
<td>Cronbach’s alpha &gt; .70</td>
</tr>
<tr>
<td>Validity</td>
<td>Content Validity</td>
</tr>
<tr>
<td></td>
<td>Face Validity</td>
</tr>
<tr>
<td></td>
<td>Subjective</td>
</tr>
<tr>
<td>Construct validity</td>
<td>Convergent validity</td>
</tr>
<tr>
<td></td>
<td>Factor loadings</td>
</tr>
<tr>
<td></td>
<td>At least .5 and preferably .7</td>
</tr>
<tr>
<td></td>
<td>Variance Extracted</td>
</tr>
<tr>
<td></td>
<td>Equal or exceed 50% while .70 is considered the threshold for reliability of a construct</td>
</tr>
<tr>
<td>Discriminant validity</td>
<td>Compares the variance-extracted estimates for each factor with the squared interconstruct correlations associated with that factor which should be greater implying that are no problems with discriminant validity</td>
</tr>
<tr>
<td>Nomological validity</td>
<td>Determines whether the scale demonstrates the relationships shown to exist based on theory and prior research</td>
</tr>
<tr>
<td>Unidimensionality</td>
<td>Factor analysis</td>
</tr>
<tr>
<td></td>
<td>Standardized loading estimates should be .5 or higher</td>
</tr>
</tbody>
</table>
III. METHODOLOGY

The methodology followed is summarized in the steps below:
A. Finalizing the items for scale to measure each construct
B. Questionnaire development and data collection
C. Consumer characteristics, sampling details and data collection
D. Data analysis

A. Finalizing the items for scale to measure each construct
Items were selected from previous studies.

Table III: Scale Items to measure constructs

<table>
<thead>
<tr>
<th>Construct</th>
<th>No</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>1</td>
<td>I would buy this brand rather than any other brand even if they are the same</td>
</tr>
<tr>
<td>Brand</td>
<td>2</td>
<td>Even if another brand has same features as this brand, I would prefer to buy this brand</td>
</tr>
<tr>
<td>(OBE)</td>
<td>3</td>
<td>If there is another brand as good as this brand, I would buy the new brand</td>
</tr>
<tr>
<td>(OBE)</td>
<td>4</td>
<td>If I had to choose among brands - I would choose this brand</td>
</tr>
<tr>
<td>(OBE)</td>
<td>5</td>
<td>If there is another brand as good as this brand, I prefer to buy this brand</td>
</tr>
<tr>
<td>Loyalty</td>
<td>6</td>
<td>I consider myself to be loyal to this brand</td>
</tr>
<tr>
<td>(OBE)</td>
<td>7</td>
<td>This brand would be my first choice when considering this product category</td>
</tr>
<tr>
<td>(OBE)</td>
<td>8</td>
<td>I will not buy another brand, in this product category, if this brand is not available</td>
</tr>
<tr>
<td>Brand</td>
<td>9</td>
<td>I am aware of this brand</td>
</tr>
<tr>
<td>Awareness</td>
<td>10</td>
<td>When I think of this product category, this brand is among the first brand that comes to my mind</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>I know what this brand looks like</td>
</tr>
<tr>
<td>Perceived</td>
<td>12</td>
<td>This brand offers very good quality products</td>
</tr>
<tr>
<td>Quality</td>
<td>13</td>
<td>The products of this brand are of consistent quality</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>This brand is of high quality</td>
</tr>
<tr>
<td>Brand</td>
<td>15</td>
<td>I can quickly recall the symbol or logo of this brand</td>
</tr>
<tr>
<td>Association</td>
<td>16</td>
<td>This brand has a personality</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>This brand has a unique brand image compared to other brands</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>I like the brand image of this brand</td>
</tr>
<tr>
<td>Price</td>
<td>19</td>
<td>The price of this brand is high</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>The price of this brand is low</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>This brand is expensive</td>
</tr>
<tr>
<td>Distribution</td>
<td>22</td>
<td>This brand is available in more stores than competing brands</td>
</tr>
<tr>
<td>Intensity</td>
<td>23</td>
<td>This brand is available in most of the retail outlets</td>
</tr>
<tr>
<td></td>
<td>24</td>
<td>This brand is distributed through as many stores as possible</td>
</tr>
<tr>
<td>Advertising</td>
<td>25</td>
<td>This brand is advertised a lot</td>
</tr>
</tbody>
</table>
I like the advertisements for this brand

The ad campaigns for this brand are seen frequently

<table>
<thead>
<tr>
<th>Price</th>
<th>28</th>
<th>Price offers/discounts are frequently offered on this brand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promotion</td>
<td>29</td>
<td>There are too many price offers/discounts on this brand</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>There are frequent price discounts on this brand</td>
</tr>
</tbody>
</table>

| Non Price Promotions | 31 | Non-price promotions like premium or prize draws for are frequently offered on this brand |
|                     | 32 | Many times non-price promotions like premium or prize draw for this brand are presented |
|                     | 33 | Prizes such as trips, raffles, scratch cards and free gifts are frequently offered on this brand |

B. Questionnaire development and data collection

Data was collected by the survey method using a questionnaire. A total of 10 constructs were to be measured. It is recommended that for each construct there should be at least 3-4 items to measure (Hair 2006). To measure the 10 constructs a total of 33 items were identified. These items were taken from scales developed earlier in various studies.

The questionnaire itself had three parts. In section 1 – the consumer was asked to select a brand from a list of brands. This list had 15 brands. Strong and big brands (no.1 or 2) in various food categories were selected across a range so as to appeal to the wider sampling target population. In section 2 the consumers had to answer questions on a 5 point Likert scale keeping the selected brand in mind. In section 3 personal data was collected.

C. Consumer characteristics, sampling details and data collection

The target sampling population was set as male or females in the age group of 18 to 60 living in Dubai and Sharjah and a member of the non-Arab expatriate community. The sample size was set at 400. This was decided on a couple of factors – one, was the rule of thumb approach of 10 responses per item giving a total number of 330. Secondly, it is recommended that the larger the sample the better it is for multivariate analysis. Finally it being convenience sampling it was decided to have a larger sample size.

Respondents were approached in key areas – residential areas, offices and colleges where they were handed the questionnaire, which was a self-filling questionnaire, for completion. Of the total 400 questionnaires sent out 318 were received back. Of the 381, 22 were rejected for reasons of being incomplete or having absurd data, leaving 359 questionnaires for analysis.

Sampling methodology followed was convenience based. Convenience sampling refers to selecting at your convenience those cases that are easiest to obtain and the selection process is continues until the required sample size has been reached and is recommended in cases where there is very little variation in the population (Saunders 2003). Sub-groups were approached in such a manner to cover the age gender and socio-economic levels. Key groups of the target population were identified in various locations such as offices, residential areas and colleges.

As the objective of the data collection was understand the marketing elements and how it drives brand equity within the FMCG food sector – a set of 15 brands were chosen in discussion with marketing professionals, market observations and discussions with consumers. The idea behind the brand is that with the brand in mind the respondents answers the questions. For brands to trigger answers they have to be strong and big brands in their categories. The criterion was that the brands should be no.1 or 2 in their respective product category. The brands were selected within the Fast Moving Consumer Goods (FMCG) category focusing on food brands. As the target consumer is across age and socio-economic level the brands were also chosen in a manner that the each consumer sub-set can choose the most familiar brand. The 15 brands chosen as stimulus to generate the data were Lipton, Galaxy, Cadbury, Afia, London Dairy, Mountain Dew, Tang, Nescafe, Pepsi, Red Label, Vimto, Coca Cola, Lurpak, Kit Kat and Red Bull.

D. Data Analysis
Confirmatory Factor Analysis using Structural Equation Modeling (SEM) software Lisrel will be used to analyze the data. Exploratory factors analysis, using SPSS, will be used to conduct factor analysis. Refer to Table II for specific parameters that will be analysed.

IV. RESULTS

Summary – Sample Characteristics:
As observed from the above analysis the total respondents of 359 within the non-Arab expatriate community is young, educated and has an average to above average household income. Both the genders are represented in almost equal measures at 53% male and 47% female. 91% of the respondents are below the age of 45 which is representative of the population, and is also indicative of the younger nature of the population.

Also, the brand selection was done across all the brands with sub-groups showing skews towards individual brands as per the brand objectives and consumer profiles.

In summary the sample is representative and very suitable for the brand study intended.

Reliability & Construct Validity
Cronbach’s Alpha was calculated for all the factors with 33 items, using SPSS 18. 1 item was dropped and 1 changed to improve the Cronbach’s Alpha of the scales. Construct Validity was analyzed using the factor loadings. Table 4 summarizes the findings.

The constructs that produced the highest Cronbach’s Alpha were Non-Price Promotions (.85), Price Promotions (.82) and Brand Equity (.83). The other constructs above .7 were Price (.78), Advertising (.79) and Distribution was very near at .68. The rest of the constructs were less than .7 but over .6 – brand loyalty (.62), brand awareness (.62), perceived quality (.65) and brand associations (.61). These constructs were acceptable as they were close to the acceptable limit of .7.

Table IV: Scale Items to measure constructs

<table>
<thead>
<tr>
<th>No</th>
<th>Variable Item Description</th>
<th>No of Items</th>
<th>Cronbach’s Alpha (&gt;0.7)</th>
<th>VE (&gt;0.5)</th>
<th>CR (&gt;0.7)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Price</td>
<td>3</td>
<td>0.78</td>
<td>0.57</td>
<td>0.79</td>
<td>Acceptable</td>
</tr>
<tr>
<td>2</td>
<td>Distribution Intensity</td>
<td>3</td>
<td>0.68</td>
<td>0.45</td>
<td>0.71</td>
<td>Marginal</td>
</tr>
<tr>
<td>3</td>
<td>Advertising</td>
<td>3</td>
<td>0.79</td>
<td>0.56</td>
<td>0.79</td>
<td>Acceptable</td>
</tr>
<tr>
<td>4</td>
<td>Price Promotions</td>
<td>3</td>
<td>0.82</td>
<td>0.61</td>
<td>0.83</td>
<td>Acceptable</td>
</tr>
<tr>
<td>5</td>
<td>Non-Price Promotions</td>
<td>3</td>
<td>0.85</td>
<td>0.66</td>
<td>0.85</td>
<td>Acceptable</td>
</tr>
<tr>
<td>6</td>
<td>Brand Loyalty</td>
<td>3</td>
<td>0.62</td>
<td>0.37</td>
<td>0.63</td>
<td>Marginal</td>
</tr>
<tr>
<td>7</td>
<td>Brand Awareness</td>
<td>3</td>
<td>0.62</td>
<td>0.35</td>
<td>0.61</td>
<td>Marginal</td>
</tr>
<tr>
<td>8</td>
<td>Perceived Quality</td>
<td>3</td>
<td>0.65</td>
<td>0.40</td>
<td>0.66</td>
<td>Marginal</td>
</tr>
<tr>
<td>9</td>
<td>Brand Associations</td>
<td>4</td>
<td>0.61</td>
<td>0.91</td>
<td>0.62</td>
<td>Marginal</td>
</tr>
<tr>
<td>10</td>
<td>Overall Brand Equity</td>
<td>4</td>
<td>0.83</td>
<td>0.54</td>
<td>0.83</td>
<td>Acceptable</td>
</tr>
</tbody>
</table>

Unidimensionality
Factor analysis was run on SPSS. The factors were inline with the theoretical assumptions. Refer to table 5 for findings.

Table V: Factorisation

<table>
<thead>
<tr>
<th>Price</th>
<th>PR1</th>
<th>0.78</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PR2</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>PR3</td>
<td>0.87</td>
</tr>
</tbody>
</table>
### Table 1: Constructs and Measures

<table>
<thead>
<tr>
<th>Domain</th>
<th>Item</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution</td>
<td>DI1</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>DI2</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>DI3</td>
<td>0.78</td>
</tr>
<tr>
<td>Intensity</td>
<td>AD1</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>AD2</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>AD3</td>
<td>0.82</td>
</tr>
<tr>
<td>Advertising</td>
<td>PP1</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>PP2</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>PP3</td>
<td>0.81</td>
</tr>
<tr>
<td>Price</td>
<td>NPP1</td>
<td>0.77</td>
</tr>
<tr>
<td>Non-Price</td>
<td>NPP2</td>
<td>0.81</td>
</tr>
<tr>
<td>Promotions</td>
<td>NPP3</td>
<td>0.85</td>
</tr>
<tr>
<td>Loyalty</td>
<td>LO1</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>LO2</td>
<td>0.64</td>
</tr>
<tr>
<td></td>
<td>OBE3</td>
<td>0.45</td>
</tr>
<tr>
<td>Brand Awareness</td>
<td>AW1</td>
<td>0.53</td>
</tr>
<tr>
<td>Awareness</td>
<td>AW2</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>AW3</td>
<td>0.53</td>
</tr>
<tr>
<td>Perceived Quality</td>
<td>PQ1</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>PQ2</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>PQ3</td>
<td>0.68</td>
</tr>
<tr>
<td>Brand Associations</td>
<td>AS1</td>
<td>0.51</td>
</tr>
<tr>
<td></td>
<td>AS2</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>AS3</td>
<td>0.53</td>
</tr>
<tr>
<td></td>
<td>AS4</td>
<td>0.56</td>
</tr>
<tr>
<td>Overall Brand</td>
<td>OBE1</td>
<td>0.70</td>
</tr>
<tr>
<td>Equity</td>
<td>OBE2</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>OBE4</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>OBE5</td>
<td>0.74</td>
</tr>
</tbody>
</table>

### V. DISCUSSION

33 items were used to test 10 constructs. One item was removed from Loyalty and a Brand Equity item was moved to Loyalty as it showed better reliability. Overall the scale items showed good construct reliability and can be used in brand equity studies or to construct measurement scales within the English speaking expatriate community in UAE. As a practical use for marketing professionals - these scales can be used to measure brand equity within a category. Furthermore, they can also be used to measure brand equity dimensions of Loyalty, Awareness, Quality and Associations. This will allow brand managers to identify the strength and
weaknesses of their brands and allocate effort and resources accordingly. Some of the scales can be made more robust by increasing the number of items or changing the scale item description.

REFERENCES


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Implementation of Bill Deduction in ETC System based on IoT and RFID Technology

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Abstract
The paper presents the bill deduction with cloud of Thingspeak webserver in Electronic Toll Collection (ETC) system for toll tax collection based on IoT and RFID technology. The existing toll collection systems in Myanmar have been applied to manual cash Management observed in past years. Manual toll collection systems are main blockage of high speed commutation scheme. The paper points out the office computerization system using internet of things technology. All data can be processed and transferred by applying Thingspeak website to upload the data over cloud server. Then the message data could be displayed with the scanned RFID cards, bill deduction records and the number of passing cars on Toll plaza on the android mobile phone which was sent by wireless communication environments. This work has been implemented ETC system using RFID reader with passive RFID tags, ESP8266 Node MCU Wi-Fi and Blynk software which has already installed into the android mobile phone. The toll is deducted by administrative user account for every time and it can be passed through a toll plaza. The electronic system can convey transparency in toll tax collection and make anti-corruption and tax evasion issues.

Key Words: Bill Deduction, Internet of Things, Wireless Technology, ETC System, Hardware Implementation, Software Development

1. Introduction
Radio frequency identification (RFID) is one of the wireless communication technologies that can be used to distinguish tagged objects, people or animals. The applications areas for RFID are growing speedily. This includes supply chain management, access control to building, security systems, animal identification, public transportation, healthcare, open-air events, air-port baggage, and excess parcel logistics and so on. RFID scheme consists of readers and a huge number of tags. A tag has an identification number (ID) and a reader recognizes an object through consecutive communications with the tag fond of it. The reader sends out a signal which supplies power and instructions to a tag. The tag transmits its ID to the reader consults an external database with received ID to recognize the object. In this paper, RFID system has been developed with 125 kHz, FSK modulation scheme. Toll tax collection systems in Myanmar are based on manual cash business. The operator at the toll booth manually collects toll amount according to vehicle type, in form of cash invoices. He hands the receipt for same amount. This may be time consuming. Due to that systems blockage, the proposed method is created in the high speed highways. There are chances of error, time wastage, and longer queues leading to fuel wastage. The IoT-based electronic toll collection system works as a centralized server which stores database of users. It has private android open source paper support of Apache, JobQueue, Facebook Android SDK and Twitter Kit for Android for a standalone function.

2. Related Works
Many electronic toll collection systems were implemented with diverse techniques. The [1] mentioned Wi-Fi for communication with the smart phone user. This phone contains all necessary data related to the user registration sections. User can easily register at toll booth automatically as he passes through it. But in countries with less smart phone penetration,
that system might not work effectively. The [2] presented overhead camera to detect number plate and used it as the account number of the user. Database is stored in central server. But decline of number plates or duplicate numbers might introduce false positives in the system. The [3] worked on NFC chips for detection of vehicle identity. The NFC chips were designed to effort in the close environs of the reader. If the distance between reader and chip is more than critical limit, that system would not detect to the vehicle. Considering the limitations of many past systems, RFIDs are prominent with many recompense and the tags needs no battery as they can work completely with the power transmitted by RFID reader. Distance of tag from reader is no issue as high power radio waves can easily detect the tag up to sufficient distance for recognition. Unlike Wi-Fi it does not require any authentication consequently faster than system has been proposed in [1]. More to this system, the IoT based toll collection system using Blynk Cloud of account “ant.rfid@gmail.com” can be provided a cost effective implementation as components are fairly inexpensive.

3. System Design
This system was implemented with following hardware components:
- ESP8266 Node MCU
- RFID Reader RC 522
- RFID passive tags

The next is an antenna for receiving and transmitting the signal. A reader is fundamentally a radio frequency RF transmitter and receiver, managed by a microprocessor. It works on a 5V power supply. Typical power consumption is less than 50mA. The reader, using an attached antenna, captures data from tags, then passes the data to the cloud.

The number controlled in RFID tag is of 11 digits in HEX format. This number is sent via either serial interrupt or Wiegand protocol [4-5].

4. RFID Reader
A Radio Frequency Identification scheme consists of an antenna or coil, a transceiver and a transponder programmed with original information. RFID tag consists of a microchip associated to an antenna, which is created to a small coil of wires. Data can be stored in the IC and transmitted through the antenna to a reader. Most RFID tags enclose as a minimum of two elements. One is an integrated circuit for accumulating and processing information, modulating and demodulating a RF signal, and other particular functions.

5. System Working
When the vehicle passes through the toll plaza, the RFID tag can be detected by the RFID receiver positioned overhead. This reader is regularly emitting RF waves at 125 kHz. As soon as the tag comes in field of receiver, the tag number is detected and sent to MCU (Microcontroller Control Unit) via serial port communication. The LCD can be displayed the message from the card detection and the card number.

If sufficient balance is found in corresponding user account then stipulated amount will be deducted. This amount depends upon the sort of vehicle. The motor driver can control to open the gate for 30 seconds and the vehicle can cross the toll booth. In case of insufficient balance in the user account, the user could have to pay toll cash in manually with some penalty. The user can easily recharge the certain account from the toll booth itself. The sort of vehicle from initial registration can be identified. New user can also be registered at the toll booth.

Current system is used as a prepaid mode. This can be changed to postpaid. For the prepaid system online recharge system can be realized. By using the Blynk Community of third party and ESP8266 Node MCU

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Wi-Fi to get the most stable system of RFID through Thingspeak web and cloud server. These bill deduction and passing number of tolled cars can be accomplished the Blynk interface via Android phone.

Many types of RFID subsist, but at the higher level, there are two classes into the RFID devices: active and passive. Active tags necessitate a power source they’re either connected to a powered infrastructure or use energy stored in an integrated battery. In other case, a tag’s lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo. On the other hand, batteries make the cost, size, and life-time of active tags impractical for the retail trade. Passive RFID is relevant because the tags don’t require batteries or preservation. The tags also have an indefinite operational life and are small enough to fit into a practical adhesive label. A passive tag consists of three parts: an antenna, a semiconductor chip attached to the antenna, and some form of encapsulation.

The tag reader is conscientious for powering and communicating with a tag. The tag antenna captures energy and transfers the tag’s ID. The encapsulation maintains the tag’s integrity and protects the antenna and chip from environmental circumstances or reagents. The encapsulation could be a small glass vial or a laminar plastic substrate with adhesive on one side to enable easy attachment to goods. Two basically different RFID devise approaches exit for transferring power from the reader to the tag: magnetic induction and electromagnetic (EM) wave capture.

These two designs obtain benefit of the EM properties associated with an RF antenna-the near field and the far field. Both can relocate sufficient power to a remote tag to keep going its operation characteristically between 10 W and 1mW, depending on the tag type. Through various modulation methods, near-and far-field-based signals can furthermore transmit and receive data [4-5].

6. System Components

There are three main components to inclusive the full system for implementation.

6.1. ESP8266 Wi-Fi Module:
The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and has MCU potential. Expressive Systems’ Smart Connectivity platform (ESCP) is a set of high recital, high incorporation wireless SOCs, intended for space and power constrained mobile platform designers. It offers unsurpassed ability to embed Wi-Fi capabilities within other systems, or to function as a separate relevance, with the lowest cost, and minimal space prerequisite.

6.2. Node MCU:
The Node MCU is firmware is a cohort paper to the popular Node MCU dev kits, ready-made open source development boards with ESP8266-12E chips. The Node MCU is an open-source firmware and expansion kit that helps the prototype IoT product within a script lines.

6.3. Thingspeak:
ThingSpeak is an IoT analytics platform service that tolerates cumulating, imagine and scrutinizing live data stream in the cloud. ThingSpeak affords instant visualizations of data posted by our devices to ThingSpeak. With the ability to execute Arduino code and ThingSpeak, the online investigation and dispensation of the data as it comes in can be achieved.
Figure.4. Flow Chart of Software Configuration

Figure.5. Mobile hotspot

Figure.6. Blynk Software configuration

Figure.7. RFID and ESP8266 based ETC Bill System

Figure.8. Balance Monitor of ETC Bill System

Figure.9. Total Passing Cars in Toll Plaza
Figure 5 to 11 show the experimental results with the help of software and hardware implementation. The implementations were successfully completed based on the proposed method. The accuracy of the proposed system could easily measured by using the modified techniques for ETC system. The effectiveness of the proposed method is high performance and greater accuracy based on the analysis on proposed system.

8. Conclusion
This RFID based electronic toll collection gate has been implemented in this paper. Every RFID card has some amount to be paid in toll gate. When the car gets to the toll gate, the users need to detect their RFID card to RFID reader. Then the system deducts specific amount along with their car sort. Each RFID card encloses user identification, License number and some other information. This paper has been applied ESP8266 Node MCU and MFRC522 RFID card reader to system with Serial Peripheral Interface. The Blynk LCD of advanced mode is utilized in this paper. RFID based toll bill deduction system is more secure and fast responded as compared to the system like biometric. By using Arduino it is effortless to contact and works very speedily while burning the code and changes the function. Data analysis over the cloud is also uncomplicated using ThingSpeak website.

Acknowledgement
The author would like to thank my supervisor, head and all of my teachers from Department of Electronic Engineering, West Yangon Technological University who gave suggestions, consistent guidance, encouragement, motivation and support throughout the research period. Also, the author would like to thank the kind and patient suggestions of Mr. Yan Myo Aung of YTU, Yangon in Myanmar. Without their help it was tough job for me to accomplish this task.

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Consequences of Fame (Flubendiamide 480 sc) Exposure on Haematological Parameters of the Fish Oreochromis mossambicus

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Abstract- The haematological parameters such as Total Erythrocyte Count (TEC), Total Leucocyte Count and Differential leucocyte count (TLC and DLC), Haemoglobin Content (Hb), Packed Cell Volume (PCV), the Erythrocyte constants like Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) and Enzymes (AST/SGOT and ALT/SGPT) were estimated in the fish Oreochromis mossambicus exposed to sub-lethal concentration (10ppm) of FAME (Flubendiamide 480 SC) pesticide for four weeks. Studies in fish exposed to this chemical pesticide (amide derivative) indicated significant reduction in the blood parameters except WBC throughout the experiment. Total leucocytes showed significant increase throughout the experiment. The enzyme profile showed significant increase after 4 weeks of exposure confirming the significant impact of the pesticide on the organism.

Index Terms- flubendiamide, haematological, Oreochromis mossambicus, sub-lethal concentration

I. INTRODUCTION

Seasonal utilization of paddy fields for fish culture is quite common in Kerala and West Bengal. In recent years, with the advent of high yielding varieties of paddy, the use of pesticide has become very popular. Agricultural inputs in terms of pesticides/insecticides are increasing day by day and its residues are being drained off in to water bodies. Use of pesticides in agriculture sector and its ultimate discharge in to aquatic ecosystem have a potential toxicological concern to biota of the ecosystem including fishes (Tilak et al, 1980). Environmental pollution is one of the serious plights of the modern world. During the last decade, due to the significant increase in the environmental pollutants and lack of precautionary measure or observance of the environmental regulations, it has become the global problem (Bondarenko et al., 2004, Devi et al., 2008, Sachar and Raina, 2014). Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields (Gaafar et al., 2010, Saeed et al. 2012; Shankar et al., 2013). Pesticides in the aquatic environments can negatively affect the ecosystem.

Haematological parameters are closely related to the response of the animal to the environment, an indication that the environment where fishes live could exert some influence on the haematological characteristics (Gabriel et al., 2004, Kavitha et al., 2010). Blood offers important profile to study the toxicological impact on animal tissues. Different blood parameters are often subjected to change depending upon stress condition and various other environmental factors (Goel et al., 1985, Goel and Sharma 1987, Suvetha et al., 2010; Chaudhary et al., 2015; Prasad et al., 2015). Fishes are very sensitive to a wide variety of toxicants in water; various species of fish show uptake and accumulation of many contaminants or toxicants such as pesticides (Herger et al., 1995). Accumulation of pesticides in tissues produces many physiological and biochemical changes in the fishes and freshwater fauna by influencing the activities of several enzymes and metabolites (Nagarathnamma and Ramamurthi, 1982). Bouck and Ball (1966), Johnson (1968) and Srivastava et al. (2010) stated that fish severs as a bio indicator species as it responds with great sensitivity to changes in the aquatic environment and has an important role in the monitoring of water pollution. Blood analysis is crucial in many fields of Ichthyologic research, fish farming and in toxicology and environmental monitoring as an indicator of physiological and pathological changes in fishery management and disease investigation (Adedjii et al., 2000).

Several researchers studied the effect of various toxicants on the haematology of fishes such as hematobiological characteristics of Heteropneustes fossilis under the stress of Zinc (Goel et al., 1985), effect of zinc sulphate on haematology of dog fish (Flis et al., 1987). Ramanujan and Mohanty (1977) studied the effect of sub-lethal concentration of Endosulphan on the haematological parameters of H.fossilis. Srivastava and Mishra (1979) have reported anaemia associated with erythropenia in lolisa faciatus after exposure to lead. The significant increase in RBC number and percentage haemoglobin could be ascribed to enhanced erythropoiesis which is triggered as a typical stress response (Gill and Pant, 1985). Goel et al. (1992) reported that the results of reduced activities of AST, ALT, ACP, ALP, LDH in various organs of fish (Pontius conchonius) exposed to mercury in implies destruction in the tissues of the animals. Serum AST and ALT are important diagnostic tools in medicine and clinics, and are used to detect the toxic effects of various pollutants (Nelson and Cox, 2000). Roy and Bhattacharya (2005) noted significant changes in SGOT (AST) and SGPT (ALT) in
**Channa punctatus** exposed to As$_2$O$_3$ and indicated that the changes may be due to histopathological lesions in liver. Kallagadda et al., (2016) observed marked changes in behavioural morphology and haematological parameters in *L.rohita* exposed to flubendiamide.

Haematological parameters can be detected rapidly and hence can be used for prediction and diagnosis of pesticide toxicity. Haematologic indices are important parameters for the evaluation of fish physiological status, the changes in which depend on fish species, age, sexual maturity of spawners and disease (Zhiteneva et al., 1989, Luskova, 1997). These indices have been employed in effectively monitoring the response of the fishes to the stressors and thus their health status under such adverse conditions. The haematological indices were widely used by fish biologists and researchers (Adhikari et al., 2004; Cazenave et al., 2005; Kori-Siakpere et al., 2006; Ali and Rani, 2009; Sharaf et al., 2010; Kori-Siakpere and Ikomi, 2011 and Nte, 2011). Sequel of pesticides on haematological factors of a number of fish species have been investigated by several researchers: in *Cyprinus carpio* (Satyanarayana et al., 2004; Salvo et al., 2008); in *Clarias batrachus* (Patnaik and Patra, 2006; Kharat and Kothavade, 2012; Summarwar and Verma, 2012), in *Oreochromis mossambicus* (Ali and Rani, 2009; Desai and Parikh, 2012); in *Heteropneustes fossilis* (Deka and Dutta, 2012; Chaudhary et al., 2015; Prasad et al., 2015), and in *Puntius mesopotamicus* (Saxena and Seth, 2002; Carraschi, 2012).

Present study was carried out to analyse the effect of sub-lethal concentration of amide derivative pesticide, flubendiamide on the haematological parameters of the fish *Oreochromis mossambicus* and to estimate the impact of long term use of pesticide on the vital organ such as liver of fish by analyzing the liver marker enzymes.

**II. MATERIALS AND METHODS**

*Oreochromis mossambicus* weighing 20-30 g from the local fish farm were used for the experiment. The fish were acclimatised to the laboratory conditions in a glass aquarium filled with aerated de-chlorinated water under natural photo period for one week. The fish were fed every day. Water in the tank was renewed every day. Only healthy and active fishes of similar size were randomly selected from the aquarium tanks and used for haematological studies.

96 hour LC$_{50}$ value for the pesticide was determined using bioassay methods proposed by Doudoroff et al., (1951). From the LC$_{50}$ value a sub-lethal concentration (1/10$^{th}$ of LC$_{50}$) was calculated for the pesticide and was fixed as the experimental concentration. Fish were exposed to sub-lethal concentration (10ppm) of fame (Flubendiamide) for a period of 28 days (4week), and blood samples were taken by severing the causal vein of the fish. Haematological parameters like Total Erythrocyte count (TEC), Haemoglobin Count (Hb gm %), Packed cell volume (%), Total and differential Leucocyte Count (TLC and DLC) and erythrocyte constants (MCV, MCH, MCHC) were determined by standard methods. Blood samples were also used for the analysis of enzymes such as Alkaline transaminase (ALT/SGPT) and Aspartate aminotransferase (AST/SGOT).

### III. RESULT

Data on haematological parameters such as Total Erythrocyte count (TEC), Total Leucocyte Count (TLC), Haemoglobin Count (Hb), Packed cell volume or Haematocrit (PCV) and erythrocyte constants such as Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC) of *O.mossambicus* exposed to sub-lethal concentration (10 ppm) of pesticide FAME (Flubendiamide 480 SC) for a duration of 24 hrs to 4 weeks are represented in Tables 1 and II. Table III delineates the enzyme profile after exposure of 4 weeks. Data is represented as mean values ± Standard Error.

### IV. DISCUSSION

Water pollution is recognized globally as a potential threat to both human and other animal populations that interact with aquatic environments. Any alteration in the environment upsets homeostasis. Basically all toxicants produce adverse effect on some physiological functions in aquatic organisms. According to studies conducted by Shayeghi et al., (2001) and Honarjapouj (2003), traces of insecticides were detected several months after spraying. Peripheral haematological parameters are a reliable indicator of physiological status of fish and an effective parameter to assess the background effects of environment perturbation (Natarajan et al., 1998). At sub-lethal concentrations, the fish survive even after prolonged periods of exposure (Natarajan, 1984). Prolonged exposure in sub-lethal concentrations of the toxicant may cause a strict decline in many of haematological parameters.

The red blood cells have the important function of carrying oxygen to all tissues in the body via haemoglobin in erythrocytes. The decreased red blood cell number following exposure to pesticide could be as a result of haemolysis or destruction of red blood cells. In the present study, the total RBC count was decreased significantly on the last day of the experiment. The decrease found in total RBC might be due to the disruptive action of pesticide on the erythropoietic tissue (Larsson et al., 1985). Similar result has been reported by previous studies in *Cyprinon watsoni* due to malathion exposure (Khattak and Hafeez, 1996), in *Piaractus mesopotamicus* due to trichlorphon exposure (Tavares et al., 1999) and in carp due to chlorpyrifos (Ramesh and Saravanan, 2008, Vani et al. 2011 and Yonar et al., 2012). It has been widely reported that many pollutants denature or oxidise the haemoglobin by inhibiting glycolysis or hexose monophosphate shunt resulting in anaemia (Buckley et al., 1976). In our study too Hb content is reduced. The significant decrease of TEC and Hb during four weeks of exposure is the result of decreased erythropoietic activity.

Haematocrit is used to determine the ratio of plasma to corpuscles in the blood as well as the oxygen carrying capacity of the blood. The findings of present study agree with the previous results (Larsson et al., 1985) in which recorded a decrease in haematocrit level in brown trout after exposure to diclofanac for 7 days. The haematocrit values decrease when a fish loses its appetite or diseased (Blaxhall, 1973) or poisoned by pesticides (Gill and Pant, 1985). The reduction in packed cell volume (PCV) of *C. c. var. communis* may also be due to decreased rate of erythropoiesis as well as haemolysis as...
observed in the *Flounder pleuronectus flesus* when subjected to cadmium toxicant (Larsson, 1975). In the present study a gradual decline in blood parameters like haemoglobin content and PCV were noticed with increased exposure period. Same observations were made by Ramanujan and Mohanty (1977) while studying the effects of pesticide endosulphan on *Heteropeusites fossilis*. Thus it appears that the fish experienced a mild anaemia due to haemolysis and haemorrhage of blood cells. Similar observations were reported earlier by Tilak et al. (2001), Saravanan et al. 2010 and Saeed et al. (2012). Decreased haemoglobin content leads to decreased O₂ content, which affects the physiological state of the fish in an unhealthy way. Simultaneously increase in MCV reported in this study can be correlated with erythrocyte swelling, probably resulting from plasma acidosis and a reduction in plasma ions as given in earlier studies of Wood et al. (1989) and Milligan and Wood (1982).

Increase in TLC in the test fish could be due to stimulated lymphopoiesis and enhanced release of lymphocyte. Such lymphocyte response might be due to the presence of toxic substances or may be associated with the pollutant induced tissue damage as opined by Haniffa (1991). Increased WBC count established leucocytosis, which is considered to be of an adaptive value for the tissue under chemical stress. This also helps in the removal of cellular debris of necrosed tissue at a faster rate (Rivas, 1986). According to Sudha (2012) the increase in WBC count can be correlated with a natural response of the fish against toxic invasion. The findings of present study are also in tune with the results of previous studies.

But the increased MCV values from 24 Hrs to 4 week of exposure indicate cellular swelling and consequent macrocytosis and decrease of value due to the iron deficiency etc and thus lower haemoglobin concentration. The decreased PCV value (24 Hrs to 4 week) and MCH (24 Hrs to 4weeks) indicates the occurrence of microcytic anaemia and due to the deficiency of iron and reduction in haemoglobin synthesis and the value increased due to haemolysis. The values of blood cell indices were enhanced after the exposure and this tune with the findings of earlier studies (Ko:pru:s et al.,2006, Rao, 2010, Kallagadda et al.,2016).

The liver function tests, analysis of serum AST/SGOT and ALT/SGPT, are widely used to demonstrate liver function or toxicant-induced hepato-toxicity (Yang and Chen, 2003; Dutta et al. 1993, 1996 and 2006). Roy and Bhattacharya (2005) noted significant changes in serum, SGOT and SGPT in *Channa punctatus* exposed to As₂O₃, and indicated that the changes may be due to histopathological lesions in liver. After sub-chronic dietary, Cu exposure for 40 days increased serum AST and ALT concentrations with increasing time and dose were observed in the rockfish, *Sebastes schlegeli* (Kim and Kang, 2004). In the present study, the significant increase in AST and ALT levels in Fame treated fish indicates hepatic damage due to accumulation of the toxicant, which in turn releases these enzymes into the bloodstream.

The study suggested that, the perturbations in these haematological indices attributes to a defence reaction against toxicity of FAME through the stimulation of erythropoiesis or may be due to the disturbances that occurred in both metabolic and haemopoietic activities of fish exposed to sub-lethal concentration. The toxicant induced haematological disturbance could lead to the impairment of the fish’s ability to combat diseases, reduce its chances for survival and potential for growth and reproduction.

### V. CONCLUSION

Among pesticides, amide derivative pesticide like FAME (flubendiamide 480 SC) plays an important role in polluting the aquatic ecosystem. Fish were exposed to sub-lethal concentration (10 ppm) of flubendiamide 480 SC for 4 weeks. Haematological parameters like TEC, TLC & DLC, Hb and PCV were recorded after 24 Hrs to 4 weeks of exposure. Haematological constants like MCV, MCH and MCHC were obtained for control and experimental fishes. The TEC was recorded a significant decrease in the value at 24 Hrs to 4 week. The PCV and Hb values also showed a decreasing trend. The MCV values fluctuated during the study period. The MCH values showed decrease at 24 Hrs to 4 week. The MCHC showed a fluctuating trend from 24 Hrs to 4 week of exposures.MCH is mostly associated with haemoglobin concentration. The decreased values indicated iron deficiency and reticulocytosis and increased value may be due to haemolysis. The observations on haematological indices have provided valuable information on the fish health and its stress response.

### REFERENCES


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Table 1: Haematological parameters of Oreochromis mossambicus exposed to sub- lethal concentration (10ppm) of fame (Mean ± Standard Error)

<table>
<thead>
<tr>
<th>Duration of exposure</th>
<th>RBC (X 10⁶/mm³)</th>
<th>WBC (cells/mm³)</th>
<th>Hb (g %)</th>
<th>PCV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROL</td>
<td>5.47 ± 0.082</td>
<td>7950 ± 46.78</td>
<td>9.12 ± 0.143</td>
<td>41.40±0.425</td>
</tr>
<tr>
<td>24 HOURS</td>
<td>5.09 ± 0.021</td>
<td>8950 ± 20.00</td>
<td>8.44 ± 0.372</td>
<td>39.40±0.201</td>
</tr>
<tr>
<td>1 WEEK</td>
<td>4.72 ± 0.020</td>
<td>10100 ± 2.67</td>
<td>7.84 ± 0.312</td>
<td>35.00±0.282</td>
</tr>
<tr>
<td>2 WEEKS</td>
<td>4.05 ± 0.208</td>
<td>11320 ± 30.06</td>
<td>6.96 ± 0.057</td>
<td>31.00±0.282</td>
</tr>
<tr>
<td>3 WEEKS</td>
<td>3.93 ± 0.022</td>
<td>11970 ± 17.57</td>
<td>6.40 ± 0.282</td>
<td>28.60±0.203</td>
</tr>
<tr>
<td>4 WEEKS</td>
<td>3.21 ± 0.024</td>
<td>13350 ± 59.66</td>
<td>4.94 ± 0.051</td>
<td>22.40±0.483</td>
</tr>
<tr>
<td>'t' value</td>
<td>3.88, p&lt;0.01</td>
<td>4.12, p&lt;0.01</td>
<td>3.61, p&lt;0.01</td>
<td>3.29, p&lt;0.01</td>
</tr>
</tbody>
</table>

AUTHORS

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Phone No.9447337266

Table II: Haematological indices of *Oreochromis mossambicus* exposed to sub-lethal concentration (10ppm) of fame (Mean ± Standard Error)

<table>
<thead>
<tr>
<th>Duration of exposure</th>
<th>MCV fL</th>
<th>MCH pg</th>
<th>MCHC g/dL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTROL</td>
<td>75.68±0.881</td>
<td>16.67±0.193</td>
<td>22.08±0.235</td>
</tr>
<tr>
<td>24 HOURS</td>
<td>77.37±0.625</td>
<td>16.58±0.023</td>
<td>21.44±0.198</td>
</tr>
<tr>
<td>1 WEEK</td>
<td>74.86±0.397</td>
<td>16.61±0.020</td>
<td>22.43±0.154</td>
</tr>
<tr>
<td>2 WEEKS</td>
<td>76.52±0.959</td>
<td>17.18±0.021</td>
<td>22.50±0.284</td>
</tr>
<tr>
<td>3 WEEKS</td>
<td>72.70±0.446</td>
<td>16.28±0.017</td>
<td>22.41±0.257</td>
</tr>
<tr>
<td>4 WEEKS</td>
<td>69.63±0.280</td>
<td>15.38±0.085</td>
<td>23.00±0.583</td>
</tr>
<tr>
<td>‘t’ value</td>
<td>0.56, p&lt;0.10</td>
<td>3.86, p&lt;0.01</td>
<td>0.425, p&lt;0.10</td>
</tr>
</tbody>
</table>

Table III: Enzyme Profile of control and fish *Oreochromis mossambicus* exposed to 10ppm of pesticide for 4 weeks

<table>
<thead>
<tr>
<th></th>
<th>CONTROL</th>
<th>FISH EXPOSED TO PESTICIDE (10ppm) FOR 4 WEEKS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SGPT (U/L)</td>
<td>SGOT(U/L)</td>
</tr>
<tr>
<td>Mean</td>
<td>58.4±1.00</td>
<td>70.8±0.51</td>
</tr>
<tr>
<td>‘t’ value</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Hibiscus Sabdariffa L. Anthocyanins-Induced Changes in Reproductive Hormones of Cadmium-Exposed Rats


Department of Biochemistry, Delta State University, Abraka, Nigeria.

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Abstract- Hibiscus sabdariffa L. extracts contain powerful antioxidants that can ameliorate Cadmium (Cd)-induced reproductive toxicity, though the active molecules responsible have not been categorically stated. This study is therefore aimed at exploring changes induced by H. sabdariffa L anthocyanins (HSA) in reproductive hormones of cadmium-exposed rats. Twenty four adult male wistar rats (185±5.2g) were randomly divided into four groups and where treated for 15 days: A: control, B: Cd alone, 3mg/kg b wt, C: HSA alone, 3mg/kg b wt, Group 4: HSA Pre-CD: HSA (3g/ kg b wt for ten consecutive days) and Cd (3mg/ kg b wt) for five days. Comparison of the serum testosterone level of the control group with that of the Cd alone group showed a significant reduction (P<0.05) in the level of serum testosterone but the administration of HSA before Cd exposure significantly reverted the decrease in serum testosterone. Conversely, there was significant increase (P<0.05) in the level of serum follicle stimulating hormone (FSH) after cadmium administration (Group C) compared to animals in the control group (Group A) and those maintained on only anthocyanin alone. This decrease in serum follicle stimulating hormone (FSH) occasioned by Cd exposure was significantly (P<0.05) reversed by the administration of H. sabdariffa anthocyanin before Cd exposure. This was also observed for Luteinizing hormone. The results confirm the reproductive toxicity of Cd and the reported antioxidant capacities of anthocyanins. In addition, it gives credence to prominent role attributed to HSA in the antioxidant prowess of H. Sabdariffa extracts.

Index Terms- Antioxidants, testosterone, follicle stimulating hormone, Oxidative Stress, Anthocyanins

I. INTRODUCTION

Cadmium (Cd) is a toxic metal to which the general population is exposed via cigarette smoke, industrial products such as batteries, paints, etc and through vegetables and other agricultural products [1, 2]. Cd’s toxicity is aggravated by its relatively long half-life and its ability to accumulate in vital human tissues like kidney, liver and testis, where it causes damages [3]. The testis is very sensitive to Cd and as such Cd has been implicated in the rising cases of infertility among industrial workers and in the general population [4-8]. Cd reproductive toxicity is manifested via Cd-induced oxidative stress and is seen in reduction of testis weight and histopathological lesions leading to reduced sperm counts and impaired sperm motility [9]. Cd being a known endocrine disruptor disrupts the normal function of reproductive hormones which produce and maintain the secondary sexual characteristics of the male and also stimulate sperm production [10,11].

Since Cd’s reproductive toxicity is mediated through oxidative stress via increase in reactive oxygen species is, administration of vitamins, lipids, flavonoids and other molecules with antioxidant properties have been shown to ameliorate Cd-induced testicular damage [12-14]. In this regard, researchers have noted the ability of plant pigments such as anthocyanins as antioxidant against Cd toxicity [15-18].

Hibiscus sabdariffa Linn, also known as roselle, is an herbaceous crop native to Central and West Africa and has been reported to contain organic acids, anthocyanins, polysaccharides and flavonoids with potent antioxidant properties [19-20]. Extracts of this plant have long been in use in folk medicine to treat cases of infertility, high blood pressure, and fever [21] though the main active molecules responsible for its effects have not been categorically stated. This study is therefore aimed at exploring the possible changes induced by H. sabdariffa L anthocyanins in reproductive hormones of cadmium-exposed rats.

II. MATERIALS AND METHODS

A. Chemicals:
Reagents of analytical grade were used in this study. Cadmium Chloride, methanol, trichloroacetic acid, acetonitrile and sodium chloride were purchased from Lobal Chemic Laboratory Regents and Fine Chemicals, Mumbai – India. Enzyme Immunoassay (EIA) Assay kits for serum testosterone, follicle stimulating hormone (FSH) and LH were products of Biocheck Ltd (UK).

B. Plant Material:
Fresh calyces of H. Sabdariffa L. were dried under continuous air-flow maintained at room temperature until constant weight was achieved.

C. Extraction and Purification H. sabdariffa anthocyanins:
Anthocyanins were extracted from H. sabdariffa calyces according to the method of Hong and Wrolstad [22] as described by Orororo et al., [23].
D. Experimental animals and Experimental Design:
Twenty four (24) adult male wistar rats (185±5.2g) were randomly divided into four treatment groups and where treated for 15 days: Group A: control, B: Cd alone, 3mg/kg b wt, C: HSA alone, 3mg/kg b wt, Group D: HSA Pre-CD: HSA (3g/kg b wt for ten consecutive days) and Cd (3mg/kg b wt) for five days. At the end of the treatment period, the animals were sacrificed by cervical dislocation and blood samples were obtained by cardiac puncture into heparinized bottles and centrifuged at 3000g for 10 min. Sera collected was stored frozen until used for biochemical analysis.

E. Biochemical Assays:
Serum FSH, LH and testosterone were measured based on the principle of solid phase enzyme-linked immunosorbent assay (ELISA) using Biochek test kit.

F. Analysis of Data:
Results obtained in the study were presented as Mean ± SD. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) software. The one-way analysis of variance (ANOVA) was utilized in comparing the degree of significance of different parameters estimated and the difference between mean were considered to be significant at p<0.05

III. RESULTS AND DISCUSSION

H. sabdariffa anthocyanins -induced changes in the hormones of Cd-exposed rats is shown in Fig 1-3. Comparison of the serum testosterone level of the control group with that of the Cd alone group showed a significant reduction (P<0.05) in the level of serum testosterone. The results indicated that Cd administration lowered the level of serum testosterone and also showed that the administration of H. sabdariffa anthocyanin before Cd exposure significantly reversed the decrease in serum testosterone. Conversely, there was significant increase (P<0.05) in the level of serum follicle stimulating hormone (FSH) after cadmium administration (Group C) compared to animals in the control group (Group A) and those maintained on only H. sabdariffa anthocyanin alone. This decrease in serum follicle stimulating hormone (FSH) occasioned by Cd exposure was significantly (P<0.05) reversed by the administration of H. sabdariffa anthocyanin before Cd exposure. This was also observed for Luteinizing hormone (fig. 3), and points to the antioxidant potentials of HSA.
Increase in plasma levels of FSH after cadmium administration observed in this study could be attributed to the bioaccumulation of cadmium in the testis and is consistent with the findings of [24] who noted that through its effect on Sertoli cell activity, Cd decreases inhibin (the main inhibitory signal for FSH secretion) synthesis and release thereby causing increase in the plasma levels of FSH. This is in line with the changes observed by [25] and [26]. FSH, a pituitary glycoprotein, affects the sertoli cells to stimulate and initiate germ cell number and also enhance the production of androgens by the Leydig cells [27]. FSH also plays a significant role in the maturational stages of spermatozoon. Orisakwe et al., [28], Brian et al., [29] and Omoiyu et al., [30] previously reported that extracts of H. sabdariffa calyces are rich in phytoestrogens and thus possess estrogenic effects which reduces serum testosterone levels. Interesting, this was not observed in this study and it can be attributed to the difference in the extracts. Aqueous extracts used in those studies probably contain other bio molecules responsible for the estrogenic effects unlike the purified HSA used in this study. In consonance with the results of this study is the work of Fadairo et al., [31] who reported the protective effect of whole and anthocyanin-free aqueous extracts of Hibiscus sabdariffa L. on Cadmium-induced changes in serum reproductive hormones of Wistar Rats. Again, Ajiboye et al., [32] attributed this effect of Roselle calyx extract to its anthocyanins, a claim supported by the results of this study.

IV. CONCLUSION

This study is a confirmation of the reproductive toxicity of Cd as all the hormones assayed were significantly altered by exposure to Cd. However, the pre-treatment of Cd-exposed rats with HSA significantly normalized reproductive hormones. This effect of HSA is not unconnected with the reported antioxidant capacities of anthocyanins. The results of this study also gives credence to prominent role attributed to HSA in the antioxidant prowess of H. Sabdarriffa extracts.

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Decryption the Motive: A Descriptive Phenomenological Study of Students’ Knowledge Sharing Motivation

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Abstract- Sharing knowledge not just led to improved learning on the part of the receiver, rather, the knowledge giver could also benefit from it. This descriptive phenomenological study delved into knowledge sharing motivation of students under the Curricular Program for Science, Technology, and Engineering at Laoang National High School. Ten purposively sampled informants participated in focus group discussion with three follow-up semi-structured interview the data from which were analysed through Colaizzi (1978) method. Results indicated that communal relationship, selflessness, and no-one-gets-left-behind mantra emerged as the most predominant themes which also reflected certain noteworthy Filipino values. This direction could point to researches which unravel novel knowledge sharing activities that further polished the critical thinking skills of students.

Index Terms- Education, knowledge sharing, motivation, descriptive phenomenology, Colaizzi method

I. INTRODUCTION

The Curricular Program for Science, Technology, and Engineering (STE) was instituted to produce high school graduates who are highly responsible, morally upright, globally competitive, and work-ready learners (DECS Order 54, 1996; DepEd Order 41, 2004; DepEd Order 55, 2010). As one of the implementing schools, Laoang National High School has been producing STE graduates but not without challenges. The outcome of the program evaluation showed that on average, only half of the student entrants were able to finish the program four years later (Froilan, 2017). To this end, the researcher felt the need to develop an in-depth understanding of students’ knowledge sharing motivations as it was observed by greater number of teachers that they share information and teach their classmates at different degrees for varied reasons. They shared knowledge, tacit or explicit (Nonaka, 1998) in the form of information during recitation, when they make projects, and just any other instances where someone asked for help with their studies. Uncovering their unique motives could help teachers redesign learning activities hence improve performance.

II. RESEARCH ELABORATIONS

This descriptive phenomenological study (Husserl, 2001) involved ten purposively sampled students under the Curricular Program for Science, Technology, and Engineering. A focus group discussion with a follow-up semi-structured interview was used to gather data which then analysed through Colaizzi (1978) framework comprising seven significant steps.

Step 1. The transcripts from the focus group discussion and follow up semi-structured interviews were read several times for the researcher to emerge himself into the real life experiences of the informants. Through this whole process, he identified prior knowledge and bracketed them to devoid the present study from personal bias.

Step 2. Statements identified to be significant were extracted and labelled with transcript number, page, and line numbers so that it could be traced easily. A colleague examined and filtered these statements. There were twenty significant statements which were narrowed down to fifteen statements after the review.

<table>
<thead>
<tr>
<th>Significant Statements</th>
<th>Transcript No.</th>
<th>Page</th>
<th>Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occasionally, I only select who to teach. And most preferably close friends.</td>
<td>1</td>
<td>7</td>
<td>117</td>
</tr>
<tr>
<td>Even if it’s already night time, I really go to her house just to give assistance about our assignment or sometimes project.</td>
<td>2</td>
<td>4</td>
<td>86-88</td>
</tr>
<tr>
<td>Some of us share their knowledge in exchange of snacks.</td>
<td>1</td>
<td>10</td>
<td>146</td>
</tr>
<tr>
<td>Before, someone lent me her ballpen. One time, she asked, “How do I answer this?” Of course, I taught her because of what she did in the past.</td>
<td>3</td>
<td>5</td>
<td>112-115</td>
</tr>
<tr>
<td>“The important thing is I’m able to share my knowledge. When s/he learns, I feel great</td>
<td>1</td>
<td>9</td>
<td>125-126</td>
</tr>
</tbody>
</table>
Step 3. Significant statements were accorded meanings which were the basis for the coding process. These meanings were examined thoroughly by a colleague who specializes in language. As a result, some of the fifteen meanings were revised and improved. Sample significant statements and meanings are given below.

Table 2. Formulated Meanings Samples

<table>
<thead>
<tr>
<th>Significant Statements</th>
<th>Formulated Meanings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occasionally, I only select who to teach. And most preferably close friends. (Transcript 1, page 7, line 117)</td>
<td>Students share knowledge because the receiver is a close friend.</td>
</tr>
<tr>
<td>Even if it’s already night time, I really go to her house just to give assistance about our assignment or sometimes project. (Transcript 2, page 4, line 86-88)</td>
<td>Students are willing to go at great lengths to help classmates over their learning activities.</td>
</tr>
<tr>
<td>Some of us share their knowledge in exchange of snacks. (Transcript 1, page 10, line 146)</td>
<td>Students tutor their classmates for food.</td>
</tr>
</tbody>
</table>

Step 4. The researcher examined carefully the formulated meanings for similarity and then grouped them into clustered themes. Subsequently, closely allied cluster themes were congregated into a global theme. These themes were examined and revised by a colleague and a university instructor who both specialize in language. The researcher together with the evaluators made sure that each formulated meaning fell to only one and unique cluster theme which had a distinguished meaning from other structures (Mason, 2002). Likewise, cluster themes belonged to unique global theme. Table 3 shows samples of cluster themes with global theme.

Table 3. Cluster Themes and Global Theme Sample

<table>
<thead>
<tr>
<th>Formulated Meanings</th>
<th>Cluster Themes</th>
<th>Global Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students share knowledge just for the sake of helping and nothing more; no expectations nor something in return</td>
<td>Group achievement</td>
<td>No-one-gets-left-behind mantra (community)</td>
</tr>
<tr>
<td>Students enjoy being able to teach their classmates.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students share knowledge as their way of making sure that no one gets knocked out from the program.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Even without contribution, students are made part of the project to make sure all get a passing grade.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students feel sorry when someone gets knocked out of the program.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
class passed the subjects.

Even without contribution, a student is made part of the project to make sure all get a passing grade.

Student shares knowledge as their way of making sure that no one gets knocked out from the program.

Student feels sorry when someone gets knocked out

<table>
<thead>
<tr>
<th>Cluster Themes</th>
<th>Global Themes</th>
<th>Exhaustive Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpersonal Relationship</td>
<td>Communal relationship</td>
<td>Perceived driving force to share knowledge</td>
</tr>
<tr>
<td>Reward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Debt of Goodwill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No expectations</td>
<td>Selflessness</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1: Final Thematic Map**

**Table 4. Exhaustive Description**

<table>
<thead>
<tr>
<th>Cluster Themes</th>
<th>Global Themes</th>
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</tr>
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</tr>
<tr>
<td>Debt of Goodwill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No expectations</td>
<td>Selflessness</td>
<td></td>
</tr>
</tbody>
</table>

**Step 5.** An exhaustive description was framed anchored on the themes being articulated. In order to ensure that this description bears all of the themes, the researcher sought the expertise of a colleague, university instructor, and a research coordinator from the Division Office. The final description underwent revisions as a result.

<table>
<thead>
<tr>
<th>Cluster Themes</th>
<th>Global Themes</th>
<th>Exhaustive Description</th>
</tr>
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<tbody>
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<td></td>
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</tr>
<tr>
<td>Debt of Goodwill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No expectations</td>
<td>Selflessness</td>
<td></td>
</tr>
</tbody>
</table>

**Step 6.** A re-examination of the overall structure was administered to get rid of the redundant, inappropriate, and excessive terms and meanings. This was done so that the overall structure stayed true to the phenomenon as experienced by the students.

**Step 7.** Each of the ten informants was given a printed copy of the result including the transcript, significant statements, formulated meanings, themes, and the exhaustive description for him/her to evaluate as to its authenticity and reliability. S/he was given enough time and encouraged to feel free to pose any clarifications or give corrections in case their words were put out
of context. Eventually, all of them expressed satisfaction and offered their nod as to the credibility of the results.

**Trustworthiness of Study Results**

This study strictly followed exhaustive approaches of credibility, dependability, confirmability, and transferability to achieve trustworthiness of results which add rigor and strength to data gathering, analysis, and description (Speziale & Carpenter, 2007). Specifically, “member checking” (Creswell, 2014) was done by building an agreement between the researcher and the informants regarding the meanings and subsequent themes being formulated. A number of colleagues scrutinized the translation of the responses from Renorarte-Samarnon into English as well as the meanings and themes being drawn out. Further, revisions were made based on the suggestions and recommendations articulated by a university instructor who specializes in language. Equally important to note, the Division Research Coordinator examined the results in every step of the process.

III. RESULTS

In order to arrive at a balanced view of the results, both the Western models and Filipino Worldview models were employed (Montemayor, 2015).

Communal relationship

Interpersonal relationships. Sharing knowledge sometimes depend on the degree of relationship one has with the knowledge receiver. Ipe (2003) articulated that a person screens who to share knowledge with while Majid and Yeung (2007) asserted that knowledge sharing depends on the depth of student relationships with peers. Thus, lack of depth in peer-relationship stave off knowledge sharing among students (Jeric Yuen, Yuen, & Shaheen Majid, 2007). This relates to “pakikipagkapwa” which necessitates certain degree of close social relationship (Jocano, 2001). Hence, more efforts were being exerted when the one who solicits the knowledge is a close friend while reluctance kicks in if not. Two informants expounded on this:

“Occasionally, I only select who to teach. And most preferably close friends.”

“Even if it’s already night time, I really go to her house just to give assistance about our assignment or sometimes project.”

Reward. External motivation requires parties involved to get into a give-and-take relationship (Ipe, 2003). Since most of STE students come from very poor families, going to school is an struggle for them as studying really entails money no matter how free public education is. They come from big families where even food is scarce. In order to satisfy their hunger, they tutor their classmates for food. This reflects the Filipino value of “pakikipagkapwa” which means shared identity and being-with-others (Gripaldo, 2005). Reward can be a product of reciprocity (Ipe, 2003) which among Filipinos, is driven by “pakikipagkapuwa” (Jocano, 2001). This concurs with Bartol and Srivastava (2002) who articulated that knowledge sharing and rewards are associated. One informant’s statement exhibits this:

“Some of us share their knowledge in exchange of snacks.”

Debt of Goodwill. On another note, students share knowledge as a way to give back the favors they receive. Filipino as they are, they follow the value of debt of goodwill which de Castro (2001) argued is a more viable translation of “utang na loob” because it implies that the recipient of the favour puts a premium on good will. He expounded that there must be willingness on the part of the beneficiary to be ready to repay when opportunity calls for it. Students have imbibed this Filipino value which is very evident in their knowledge sharing behavior. A remarkable statement was:

“Before, someone lent me her ballpen. One time, she asked, “How do I answer this?” Of course, I taught her because of what she did in the past.”

Selflessness

Giving without expectation. There are students who share knowledge just for the sake of helping and nothing more; no expectations nor something in return. An act of philanthropy, “kawanggawa” is a deeply entrenched Filipino tradition (Virola, Ilarina, Reyes, & Buenaventura, 2010). This is the Filipino version of altruism, the behavior with the ultimate goal of addressing another’s welfare (Engels, 1983).

“I teach them because I wanted to help, that’s all.”

Sense of fulfilment. Students gain certain amount of happiness when their classmates learn from them. People feel satisfied after doing good for others (Luks & Payne, 2001) and these satisfaction leads to a desire to help even more (Baumeister, Bushman, & Whitford, 2010). They also feel they are useful which reflects the findings of Wymer & Self (2014) that volunteers’ need to be useful was one of their intrinsic rewards.

“The important thing is I’m able to share my knowledge. When s/he learns, I feel great that I’m able to help.”

“No only do I feel a sense of satisfaction when they learn from me. It also helps boost my self-confidence.”

“Though I am this kind of person, I can still extend help to people.”

No-one-gets-left-behind mantra

Group achievement. The informants raised the prominence of knowledge sharing as their way of making sure that everybody in the class obtained a passing grade so that all of them get promoted. Jocano (2001) explained that this sense of “community” or collectiveness among Filipinos puts emphasis on shared identity and shared goal among the members of that “community.” A popular Filipino value, working together (community spirit) or damayan (tulungan) is aimed to lighten someone’s load (Veneracion, 1996). It is also an expression of care and to share with others (Sizoo, 2010). Solidarity, Teng and Song (2011) found out, was significantly associated with sharing behaviors. This is reflected in noteworthy statements:

“I teach…so that the whole section doesn’t get dismantled or none of us gets transferred to regular class.”
“Even when someone did not help in writing the script because of family problem, we still included her so that she also obtain a passing grade.”

Empathy for dropouts. Students miss the company of those who were dropped from the program. Emotional pain strikes when someone failed the subject. Hence, they share the feelings and emotions (Foundation, 2007) of their classmates who receive failing grades thus risk of being dropped from the program. As a reaction, they teach them to improve their academic performance. In Filipino context, this relates to the value of “awa,” which goes beyond pity or sympathy or understanding. Filipinos usually share the misfortunes and sorrows of others (Jocano, 2001). This popular Filipino value is what makes students identify with and understand the feelings of being eliminated.

“It breaks my heart when someone gets knocked out of the program.”

IV. CONCLUSIONS

Understanding knowledge sharing motivation of students could be very instrumental in teachers’ decision to make adjustments in the group learning activities to effect an increase in the number of STE students who were promoted to the next grade level. The whole process further reflected the efficiency of Colazzi’s framework (1978) in constructing in-depth meaning from human experiences. It is recommended that researches be conducted on developing a richer understanding of how Filipino values form knowledge sharing behavior of students.

ACKNOWLEDGEMENT

The researcher humbly and honourably expresses his unfathomable gratitude and infinite appreciations to his mentor and friend from University of Eastern Philippines Laoang Campus, colleagues in the Department of Education, and the Division Research Coordinator of Northern Samar Division for sharing their precious time in editing this study. The same goes out to his STE students whose cooperation made this study a possibility.

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Evaluation of Antimicrobial Activities of Medicinal Plant Extracts on Common Human Pathogenic Bacteria

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Abstract - Present study aimed at the analysis of sensitivity of *E. Coli* to *Zingiber officinale*, *Azadirachta indica*, *Ocimum sanctum* and *Allium sativum*. The ethanolic extract of these four medicinal plants traditionally used in medicine, were studied for their antibacterial activity against the gram negative, *E.coli*. All the medicinal plant extracts showed inhibitory activity against *E. coli*. Among the four medicinal plants, *Zingiber officinale* showed maximum activity against the test microbe. Minimum activity was shown by *Azadirachta indica* and *Ocimum sanctum* the lowest inhibition was exerted by *Allium sativum*. The study comes to the conclusion that medicinal plants which are traditionally used in Ayurveda or in other herbal medical practices have scientific basics and can be modified to produce specific medicines against each bacterium.

Key Words: *Zingiber officinale*, *Azadirachta indica*, *Ocimum sanctum*, *Allium sativum* *E. Coli*

I. INTRODUCTION

*Escherichia coli* also known as *E. coli* is a Gram-negative, facultative, anaerobic rod-shaped bacterium of the genus *Escherichia*, that is commonly found in the lower intestine of warm blooded organisms. Most *E.coli* strains are harmless, but some serotypes can cause serious food poisoning in their hosts, and are occasionally responsible for product recalls due to food contamination. An alarming increase in bacterial strains resistant to existing antimicrobial agents demands a renewed effort to seek agents effective against pathogenic bacteria resistant to current antimicrobials. Spices are some of the most commonly used natural antimicrobial agents in foods. Natural antimicrobial compounds in spices were found to possess antimicrobial activity. Present study aimed at the analysis of antimicrobial properties of four indigenous herbs on the bacteria *Escherichia coli*.

II. MATERIAL AND METHODS

Preparation of plant extracts

50 grams of garlic cloves, ginger rhizomes and Neem and Thulsi leaves were dried in shade and ground to powder. This powder was used in ethanolic extraction using a soxhlet evaporator for 48 h. The filtrates were dried to powder form by keeping in pre-sterilized oven at 60°C. 10 gm of the ethanol extract powder was further dissolved and diluted with 100 ml DMSO to get 10% solution. Similarly 10% solution was prepared for Ampicillin also. From these 10% solutions of plant extracts and ampicillin, 1ml was taken to impregnate the filter paper discs.

Medium used - Mueller Hinton Agar, MHA (Himedia Laboratories Ltd., India) was used in the study. 3.8g of Muller Hinton Agar is added to 100 ml distilled water, mixed well and dissolved by heating with continuous stirring. Boiled for 1 to 2 minutes and autoclaved at 121°C for 15 minutes at 15 lbs. Cooled to 45°C and poured in sterile Petri plates up to a uniform thickness of approximately 4mm and the agar is allowed to set at ambient temperature.

Preparation of inoculums - The test microorganisms were maintained at 4°C on nutrient agar slants. Active cultures for *E. coli* was prepared by transferring a loopful of cells from the stock cultures to test tubes of 30 ml
nutrient broth. The inoculated tubes were incubated without agitation for 24 h at 37°. The cultures were diluted with 20 ml fresh nutrient broth before using it for plate culture.

Screening of antimicrobial properties by Agar disc diffusion method

This method (Kirby Bauer et al, 1966) is suitable for organism that grows rapidly over night at 35-37°C. A sterile cotton swab was inserted into the bacterial suspension and then rotated and compressed against the wall of the test tube so as to express the excess fluid. The surface of Muller Hinton Agar plate was inoculated with the swab. To ensure that the growth is uniform and confluent the swab is passed three times over the entire surface, by repeating the procedure, taking care the second and third time to turn the plate through 60°. 7 mm filter paper discs were impregnated with 1 ml of each of the different plant extracts. The discs were kept under refrigeration until ready to be used. Discs loaded with natural products as well as ampicillin were placed onto the surface of the agar. Discs were dispensed to the agar surface with a sterile forceps. After application, ensured that the disc has made complete contact with the agar surface by touching the top of the disc with forceps. Commercial antibiotic ampicillin and paper discs impregnated with 1ml of DMSO diluents used to dilute natural products were used as control. Tests were repeated for four times and the results were statistically analysed. Results are expressed as mean value ±SD of diameters of zone of inhibition for four replications.

III RESULTS AND DISCUSSION

After incubating for 24 hours at 37°C, the bacteria produced uniform colonies on the surface of the Muller Hinton Agar plate. Following results were obtained from the antimicrobial property assay using disc diffusion method. Table 1 de pict the statistical analysis of different plant materials and ampicillin used for anti microbial property assay in the present study.

Ampicillin -Antibiotic Ampicillin produced IZDs of 18 mm, 18 mm, 16mm, 18 mm in four different treatments. Zingiber officinale - The analysis of the inhibitory activity of extracts from Zingiber officinale (ginger) in different treatments was 11mm, 11mm, 10mm and 10mm. The maximum inhibition zone produced is of 11mm diameter.

Allium sativum - Allium sativum produced the lowest IZDs in the treatment. The four treatments of the plant extracts gave a maximum value of 7mm and a minimum value of 5mm for IZD.

**Ocimum sanctum** - The average zone diameter is 7 mm with a standard deviation of 1. **Azadirachta indica** - Neem produced IZDs of 9.5 mm, 8 mm, 9 mm and 7 mm. The average IZD is 8.38 mm with a standard deviation 1.10868.

All the medicinal plant extracts showed inhibitory activity against *E. coli*. Ampicillin produced zone of inhibition diameter up to 18 mm. Among the four medicinal plants, *Zingiber officinale* showed maximum activity against the test microbe. *Zingiber* obtaine maximum IZD of 11 mm. Minimum activity was shown by *Azadirachta indica* and *Ocimum sanctum* the lowest inhibition was exerted by *Allium sativum* in which the IZD was 6 mm. The inhibition zones were clearly visible on 24 hour incubation at 37°C. Significant difference between the inhibition zone diameters (IZDs) produced by different plant extracts were observed. This shows the difference in the antibacterial potency of these plants.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Inhibition zone diameter (Mean±SD)</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin</td>
<td>17.5 ± 0.5</td>
<td>t= 12.12435,</td>
<td>P= 1.9</td>
</tr>
<tr>
<td>Zingiber officinale</td>
<td>10.5 ± 0.5</td>
<td>t= 7.40656,</td>
<td>P= 0.00311</td>
</tr>
<tr>
<td>Azadirachta indica</td>
<td>8.38± 1.1087</td>
<td>t= 13.74772 ,</td>
<td>P= 0.0001</td>
</tr>
<tr>
<td>Ocimum sanctum</td>
<td>6 ± 0.707</td>
<td>t= 17.81572 ,</td>
<td>P= 0.0001</td>
</tr>
<tr>
<td>Allium sativum</td>
<td>7 ± 1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The indigenous medicinal system of India widely uses *Azadirachta indica* as a remedy for skin diseases. The mean IZD obtained from the treatment of the leaf extracts of *A. indica* on the tested bacteria was 9.5 mm. This indicates the strong efficiency of the leaf contents to resist the growth of bacteria.

Srinivasan, et. al., (2001) showed that about 22 Indian medicinal plants used on folkloric medicine were active against major gram negative bacteria. The results
obtained from the present study was also supporting to this . All the four medicinal plants tested, showed significant activity against the tested gram negative human pathogen, *E. coli*. All these results supported the traditional use of these medicines.

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AUTHOR

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Prevalence of Enteroparasites in Selected Fish Species

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Abstract- Prevalence of enteroparasite in three indigenous fish species Anabas testudineus, Heteropneustes fossilis, and Mystus gulio from six different regions of Vembanad Lake was studied. About 15 species of parasites were identified from the alimentary canal of observed fish hosts. Of the 15 parasites identified, five of them comprised trematode worms; six of them comprised nematode worms, one acanthocephalon, one Ciliophora, one crustacean and one Myxozoa. Most of the parasites were observed in the intestine of host fish. Crustacean Noto diaptomus and nematode Huffmanella sp were present in both stomach and intestine. The nematodes Acanthocephalon sp and Centrocestus canius were present in their larval stages. Other parasites were in their adult stage. Anabas testudineus had the highest parasitic prevalence. All the observed specimens of Anabas testudineus were infected with Camallanus anabantis and Capillaria sp. All of Heteropneustes fossilis showed infestation of Capillaria sp. Entire Mystus gulio was infected with Myxozoa sp. Acanthocephalon Pallisentis sp. was present in all the three host species. Highest mean abundance was exhibited by Myxozoa sp in M. gulio. Greatest mean intensity was exhibited by Parascarophis sp in A. testudineus.

Index Terms- acanthocephalon, enteroparasite, mean abundance, prevalence, trematode

I. INTRODUCTION

India’s inland fishery resources are acclaimed for their fish diversity and their spectacular productive potential. Kerala is gifted with a vast expanse of inland waters like rivers, canals, estuaries, lakes, ponds, tanks, etc. and they always attracted attention for its fish production. It has been recognised as a powerful income and employment generator. Fish diseases form the most serious limiting factors in fishery sector and they act as prime cause for poor growth and severe mortality that affects the fish yield and its marketability. Since fishes are prime source of protein they act as carriers of parasites and intermediate host of various parasites (Luangphai, 2004). Previous research studies on fish parasites regularly reported the presence of protozoans, myxozoans, monogeneans, digeneans, larval cestodes and ectoparasitic crustaceans in fish (Das, 2002; Mondal et al., 2014).

It is believed that parasites are as important as their host fish. Even though fishes are good source of quality protein, but their various diseases due to parasitic infections raise threat to culture fish (Yooyen et al., 2006). MacKenzie (1999) opined that parasites can signal information about environmental pollution. Heavy endoparasitic infestations impede the normal growth of fish. Heavily infested fishes were posed to food deterioration and ultimately leading to their death (Gupta et al., 1953). Bashirullah (1972) succeeded in locating Encredium dacci, Camallanus adamsia, Camallanus ophicephali, Pallisentis sp. in the intestine of Chauna sp. and Genarchopsis sp. in the stomach. Chowdhury (1992) was also able to recover these parasites except the helminthes Genarchopsis sp. Intestinal parasites infest the liver of the host fish and inhibit digestive activity by inhibiting vitamin and blood sugar metabolism and finally affecting their growth (Rohde, 1993).


Parasites are ubiquitous, primarily surviving in a dynamic equilibrium with their host and they are often overlooked in fish health assessments. Changes in the environment, both anthropogenic and environmental, can alter the parasite/host equilibrium and cause disease or mortality in fish. Therefore it is imperative that one should have knowledge of both parasites and parasitic communities within a host fish population. With the increasing attention in aquaculture throughout the world, parasitic infestation are treated as one of the major threats for fish health management and aquatic crop production.

In the present study an attempt was made to analyse the enteric parasites in three edible fish species viz. Anabas testudineus, Heteropneustes fossilis and Mystus gulio collected from Vembanad Lake.

II. MATERIALS AND METHODS

The fish hosts were randomly sampled (n=100) from each species. Selected species were Anabas testudineus, Heteropneustes fossilis and Mystus gulio. Pithed fish were examined for parasites in three regions of alimentary canal (1) mouth and the buccopharyngeal cavity, (2) stomach from gullet to the pylorus, and finally (3) the intestine. The parasites collected were identified and preserved and photographed for further studies. Prevalence, Mean Intensity, Abundance or Relative Density was determined using the statistical method given by Margolis et al. (1982) and presented in percentage.

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III. RESULT

A total of 100 fishes from each fish species was observed for the enteroparasitic infestation. About 15 species of parasites were identified from the alimentary canal of observed fish hosts (Table 1). Of the 15 parasites identified, five of them comprised trematode worms; six of them comprised nematode worms, one acanthocephalan, one ciliophora, one crustacean and one myxozoa.

Most preferred habitat for these parasites in the host body was intestine. However, two parasites (crustacean Notodiaspiom and nematode Huffmanella sp) were found in intestine as well as stomach. Out of fifteen parasites, the nematodes Ascaridida sp and Centrocestus canius were at their larval stages. Other parasites were at their adult stage. Anabas testudineus exhibited twelve parasites, Mystus gulio was infected with five parasites whereas Heteropneustes fossilis contained only three parasites.

Table 2 depicts the prevalence of parasitism in three fish species. All the three host species showed 100% parasitic prevalence. All the observed Anabas testudineus were infected with Camallanus anabantis and Capillaria sp. All of Heteropneustes fossilis showed infestation of Capillaria sp. Entire Mystus gulio was infected with Myxozoa sp., Acanthocephalon Pallisentis sp. was present in all the three host species.

Highest mean abundance (Table 3) was exhibited by Myxozoa sp (2000) in M. gulio followed by Camallanus anabantis (686.66) in A. testudineus and Capillaria sp (520) in H. fossilis. Least mean abundance was delineated by Notodiaspiom (5) in M. gulio.

Greatest mean intensity (Table 4) was exhibited by Parascarophis sp. (3000) in A. testudineus followed by Myxozoa sp. (2000) in M. gulio. Least mean intensity was exhibited by Rhabdochona sp (164.28).

IV. DISCUSSION

The biotic robustness of an ecological system often reveals the health of organisms occupying that system. In an aquatic ecosystem, those species that occupy the top of food chain like fish are generally regarded as symbol of overall system health. Parasitic infections in fishes are exceptionally regular, especially in wild population of diverse aquatic environments, where ecological requirements for intermediate hosts and parasite transmission are met. Parasitism affects the fishery industry by different ways such as retarding growth, mechanical injury, transmission are met. Parasitism affects the fishery industry by different ways such as retarding growth, mechanical injury, reproductive damage etc., which brings a huge economic loss. Along with fishery, it can also reduce the population of different animals, which are the final host of the parasite including human being.

Carnivorous fish generally noted for their rich parasite faunas than the herbivorous forms in both natural and culture systems (Beevi and Radhakrishnan, 2012). This corroborates the findings of the present study, in which all the three host fishes were carnivorous and they showed high abundance of parasites. The highest prevalence and mean abundance of parasitic manifestation was observed in A. testudineus. This might be due to its high predaceous feeding habit and its habitat. The high prevalence of nematode and trematode parasite may be due to the fact that their intermediate host viz. copepods form the chief diet of A. testudineus (Esch et al.,1990; Nnor et al., 2004; Iyaji et al., 2009; Lagrue et al., 2011.)

The recovery of intestinal nematode Camallanus anabantis from A. testudineus in the present study was corroborated by the result of earlier studies (Aruna et al., 2011; Ranibala et al., 2013; Das and Goswami, 2014; Bhuiyan et al. 2014). Even though earlier studies reported this parasite species in other fish species also (Soota, 1983), in the present study it was present only in A. testudineus.

Extensive array of protozoan form most commonly encountered metazoan as fish parasites (Klinger and Floyd, 2002). Both ecto and endo-parasitic protozoa cause damage to fish, by tearing down the skin and gill epithelium, hence even moderate protozoan infection was fatal to the host (Reda, 2011). Present investigation encountered a Ciliophora, Trichodina sp. in the buccal cavity of A. testudineus, even though they are considered as ectoparasites.

Digenean parasites prefer mucosa and epithelial tissue, hence, they will be clustering in the intestine, where the epithelial turnover rate is at its maximum (Crompton, 1973). Results of this earlier study endorse the presence of two digenean parasites in the posterior part of the gut in this study. The possession of thick cuticle by nematode larvae justifies their occurrence in the stomach, which equip them to tide over the harsh conditions while moving through the stomach to complete their life cycle.

Variations in composition, prevalence, abundance and intensity exhibited by parasites in the present study can be associated to factors such as host specificity, physico-chemical properties of water, metabolic state and weak immune system of fish. Accessory respiratory organ empower A. testudineus to survive in extremely unfavourable water. This accounts for abundance of parasites in A. testudineus when compared to the other host species.

V. CONCLUSION

Prevalence of enteroparasite on three species of fish from six different regions of Vembanad Lake was studied to identify the diversity of enteroparasite. About 15 species of parasites were identified from the alimentary canal of observed fish hosts. Of the 15 parasites identified, five of them comprised trematode worms; six of them comprised nematode worms, one acanthocephalan, one ciliophora, one crustacean and one myxozoa. Most of the parasitic diversity was observed in the intestine of host fish. Crustacean Notodiaptomus and nematode Huffmanella sp. were found to be present in both stomach and intestine. The nematodes Ascaridida sp. and Centrocestus canius were present at their larval stages. Other parasites were in their adult stage. Anabas testudineus had the highest parasitic prevalence. All the observed Anabas testudineus were infected with Camallanus anabantis and Capillaria sp. All of Heteropneustes fossilis showed infestation of Capillaria sp. Entire Mystus gulio was infected with Myxozoa sp. Acanthocephalon Pallisentis sp. was present in all the three host species. Highest mean abundance was exhibited by Myxozoa sp. in M. gulio. Greatest mean intensity was exhibited by Parascarophis sp. in A. testudineus.
REFERENCES


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Table I: Intensity of enteroparasites in host fishes

<table>
<thead>
<tr>
<th>PARASITE SPECIES</th>
<th>C. canius</th>
<th>S. falcatus</th>
<th>C. anabantis</th>
<th>N. diaptomus</th>
<th>Trichanoratus sp</th>
<th>Hali Mahmouda sp</th>
<th>Pallisentis sp</th>
<th>Rhabdochona sp.</th>
<th>Trichodina sp</th>
<th>Myxozoa sp</th>
<th>Acanthocephalum sp</th>
<th>Acetodextra sp</th>
<th>Parascarophis sp</th>
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<td>+84/22</td>
<td>+485/100</td>
<td>+122/41</td>
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</table>

+, Presence of parasite; numerator: number of parasites recovered; denominator: number of infected fish.
### Table II: Prevalence (%) of enteroparasites in host fishes

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<tr>
<th>PARASITE SPECIES</th>
<th>C.canius</th>
<th>S.falcatus</th>
<th>C.anabantis</th>
<th>N.diaptomus sp.</th>
<th>Trianchoratus sp</th>
<th>Huffmanella sp</th>
<th>Capillaria sp</th>
<th>Pallisentis sp</th>
<th>Rhabdocoelos sp.</th>
<th>Trichodina sp</th>
<th>Ascaridida</th>
<th>Myxozoa sp</th>
<th>Acanthostomum sp</th>
<th>Acetodextra sp</th>
<th>Paracotopilus sp</th>
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### Table III: Mean abundance of enteroparasites in host fishes

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<th>H. manella sp</th>
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<th>Huffmanella sp</th>
<th>Capillaria sp</th>
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<th>Rhabdochona sp</th>
<th>Trichodina sp</th>
<th>Ascaridida</th>
<th>Myxozoa sp</th>
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<tr>
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Table IV: Mean intensity of enteroparasites in host fishes

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<th>Pallivirus sp</th>
<th>Rhabdochona sp</th>
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<th>Acetomystus sp</th>
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Abstract- Bone anchored hearing aid is used for hearing rehabilitation in those patients with conductive or mixed hearing loss who cannot be benefitted with a traditional air conduction hearing aid. The success of the implant depends on its osseointegration with the scalp bone which in turns depend on quality and thickness of the bone, that has to be more than 2.5 mm. Here, we suggest an innovative technique to measure bone thickness both pre-operatively and intra-operatively. High resolution computerised tomography was performed with button cell in place. Scans were reviewed to measure the bone thickness behind temporoparietal suture line. The site of artefact produced by the button cell was also noted. The bone thickness corresponding to the site of artefact was noted and considered during the surgery for the implant. To further increase the accuracy, we used a measuring rod as a tool to assist in intraoperative measurement. The measuring rod is in different sizes of 2mm, 2.5mm, 3mm, 3.25mm, 3.5mm and 3.75mm. This too helped us to find the optimum thickness before fixture placement at the site and avoid complications. Meticulous placement of the implant at the correct site avoids extrusion of the implant. Hence, we recommend measurement of bone thickness pre-operatively and intra-operatively. Use of button cell artefact in high resolution computerised tomography of temporal bone is a simple and effective technique to choose the site of implant placement pre-operatively and use of depth gauge intra-operatively. In our series, it has helped us avoiding multiple drill holes.

Index Terms- Baha, Bone thickness, HRCT temporal bone, button cell, measuring rods

Measurement of Bone Thickness in Baha: How we do it?

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I. BACKGROUND

Bone anchored hearing aid is used for hearing rehabilitation in those patients with conductive or mixed hearing loss who cannot be benefitted with a traditional air conduction hearing aid. Occasionally patients with single sided deafness also opt for Baha. It was first introduced in 1977 by Tjellstrom, now more than 15 000 patients have been fitted with Baha implant all over the world.[1,2]

The success of the implant depends on its osseointegration with the scalp bone which in turns depend on quality and thickness of the bone. The important prerequisite being thickness more than 2.5 mm. High resolution computerised tomography of the temporal bone is performed during the pre operative work up of the patient to determine bone thickness. It is measured behind the temporoparietal suture line.

In this article we suggest an innovative technique to measure bone thickness both pre-operatively and intra-operatively.

II. PROCEDURE

We describe a novel way to measure skull bone thickness pre-operatively in patients with congenital external ear deformity to locate the most appropriate site for Baha implantation.

Our patients with bilateral congenital microtia with bilateral moderately severe conductive hearing loss along were posted for Right sided Baha implantation surgery. Head was shaved pre-operatively four finger breadths above and behind the malformed ear. Orbitomeatal line was extrapolated to approximately 6.5 mm behind the pinna thereby leaving space for pinna reconstruction in the future and site was marked and button cell was put over it. (Figure 1) This was kept in place using transpore. High resolution computerized tomography was performed with this in place. Axial and coronal cuts of the scan were reviewed to measure the bone thickness behind temporoparietal suture line. The site of artefact produced by the button cell was also noted. (Figure 2) The bone thickness corresponding to the site of artefact was noted and considered during the surgery for the implant.

At the time of surgery, while drilling hole for implant with the guide drill, we used measuring rods of different sizes 2mm, 2.5mm, 3mm, 3.25mm, 3.5mm and 3.75mm to assess the bone thickness intra-operatively. These are custom made by us to measure the depth of the hole intra-op, thereby indirectly measuring the bone thickness. (Figure 3)

Whenever we found the bone thickness was more than 3mm the spacer was removed and 4 mm drilling was done.
III. DISCUSSION

Baha is a percutaneous implantable hearing aid and depends on the concept of both osseointegration and bone conduction hearing. It consists of implant which is known as fixture, transcutaneous abutment and sound processor. The fixture usually comes in two sizes of 3mm and 4mm and the selection by the surgeons is dependent on the bone thickness and quality of the bone at the site of implantation.

Bone quality in children differs from the adult in many ways. Children usually have a soft bone due to low mineral content and high water content. U.S food and drug administration recommends Baha in children more than 5 years of age as minimum bone thickness of 2.5 mm is necessary for fixture placement. Younger children are provided with Baha soft band which is attached to the processor which allows for early stimulation of the cochlea and further speech and language development.

The skull thickness in children with congenital external ear deformity can be a considerable factor hindering proper placement of Baha implant.\(^3\) As we know that skull thickness of at least 2.5 mm is needed if a 3mm long fixture is to be placed.\(^4\) If the bone thickness is more than 2.5 mm then fixture placement, abutment insetion and soft tissue reduction is done in the same setting called as Baha FAST. Otherwise, surgeons go ahead with a two staged Baha surgery where in the first stage only the implant and with cover screw are is placed and abutment is placed in the second stage after removing the cover screw. The thickness of the bone not only decides the size of the fixture but also whether the surgery can be done at one go or needs staged procedure.

In one of the studies by Tjellstrom in 2004, they measured the skull bone at the site of Baha implant and variations in the bone thickness were observed in children as well as in adolescence. The average thickness at the 5 years of age came out to be just 2 mm. Also they observed that during surgery, the dura of the middle cranial fossa was exposed at the floor of drilled guide hole in more than 25 % of cases, which means we have to be extremely careful during the surgery in order to avoid devastating complications such as dural tears, subdural haematoma, cerebrospinal fluid leak, bleeding from sigmoid sinus. Meticulous placement of the implant at the correct site avoids extrusion of the implant. Hence, we recommend measurement of bone thickness pre operatively and intra-operatively. Use of button cell artefact in high resolution computerised tomography of temporal bone is a simple and effective technique to choose the site of implant placement pre-operatively and use of depth gauge intra-operatively. In our series, it has helped us avoiding multiple drill holes.

Acknowledgement: None

Disclosure of potential conflicts of interest: None of the authors have any conflict of interest

Ethical approval: All procedures performed were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent: Informed consent was obtained from the patient included in this study.

Role of funding source: None

Figure legends

Figure 1: Showing button cell placement at the possible site of implant before HRCT temporal bone
Figure 2: Axial cuts of HRCT temporal bone showing site of artefact produced by the button cell
Figure 3: measuring rods of different sizes 2mm, 2.5mm, 3mm, 3.25mm,3.5mm and 3.75mm to assess the bone thickness intra-operatively. These are custom made by us to measure the depth of the hole intra-op, thereby indirectly measuring the bone thickness.

REFERENCES


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Intestinal parasitoses in children residents in DAREI orphanage, Manhuaçu city, Province of Minas Gerais, Brazil

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Abstract- Enteroparasites are helminths and protozoa that colonize the intestine of vertebrates and constitute one of the great problems of global public health. Parasitoses may interfere with the nutritional status and the growth of the infected ones, compromising the intellectual development of the children and reflecting on low rate of school achievement. Objective: perform a parasitological survey in children living at the DAREI orphanage. Materials and methods: 28 stool samples, representing the universal population, were examined. The sample of each child was preserved in Merthiolate-Iodine-Formol (MIF) solution and laboratory tests were performed at the Laboratory of Parasite Diseases of the Manhuaçu Management Sciences School (FACIG). The research used technique of Hoffman, Pons & Janer for parasites identification. Results: There were found infections by the nematode helminth species Ascaris lumbricoides and Trichuris trichiura, the cestoid of the species Hymenolepis nana, and protozoa of the species Giardia lamblia and Entamoeba coli. Five stool samples (18.6%) were positive to enteroparasites. This research contributed to know the parasitoses which affects children of the orphanage and was the base for appropriate medication intervention.

Index Terms- Parasitic diseases, enteroparasitoses, children parasitism, orphanage.

I. INTRODUCTION

The worldwide frequency of enteroparasites and the harmful consequences of the parasitic diseases to the human body make them considered a serious global public health problem. The prevalence rates are directly associated with the environmental, social, economic, cultural and educational conditions of the infected populations. High rates are generally associated to environment problems like water or soil pollution. The individual do not generally cause high lethality, but some isolated or associated infections can affect nutritional balance, induce intestinal bleeding, promote nutrient malabsorption, compete for micronutrient absorption, reduce food intake or cause surgical complications such as rectal prolapse, obstructive diarrhea abscess or duodenal abscess. As a result of the spiking action, iron deficiency anemia may occur, which in adults occasionally leads to decreased reproductive capacity.

The World Health Organization estimated that there are 1.38x10⁹ people in the world parasitized by Ascaris lumbricoides and 250x10⁶ of them are diseased; 1.25x10⁹ are parasitized by hookworms, which 151x10⁶ are sick; 45.5x10⁶ cases of trichuriosis; 1.7x10⁶ cases of onchocerciasis. These parasitoses are important public health problems because, besides the constantly life threat of large part of the population, can cause considerable economic losses with health care, productivity reduction or labour incapacitation.

This research has the objective to investigate the occurrence of enteroparasites in children living at the DAREI orphanage in the city of Manhuaçu, Province of Minas Gerais, Brazil.
II. MATERIAL AND METHODS

The research was performed in the city of Manhuaçu, Province of Minas Gerais. The city has an area of 627,281 Km² and is located in the region of the Zona da Mata and the micro-region of Manhuaçu. The city is 290 km distant from Belo Horizonte, Province capital. Has an average altitude of 635 meters; tropical climate with rains during the summer and average annual temperature around 21°C. It is geographically inserted in the Doce river basin, being crossed by the Manhuaçu river. Services and coffee production represents the main economic activities of the region. The population is 84,934 inhabitants according to the 2010 IBGE census, with a population density of 135.4 inhabitants/km².

The staffs and the volunteers of DAREI orphanage provide all the necessary requirements to maintain the infrastructure in an excellent condition to children care. The orphanage hosts 28 children with less than eight years old. This research has a cross-sectional, descriptive and observational design, conducted with children of both genders living at the orphanage. In order to know the diversity of species and the prevalence of enteroparasitoses among children of the orphanage, 28 stool samples were collected, characterizing a universal sample of the population (28 children). The staffs of the orphanage were oriented about the sample collection. Stool aliquots were conserved in Methiolate-iodine-formaldehyde solution (MIF) and sent to the Laboratory of Research on Parasitic Diseases of the FACIG School of Medicine. The exams were performed using the spontaneous sedimentation method of Hoffman, Pons and Janer. For the diagnosis and to determine the presence of protozoan cysts, helmhinh eggs and larvae, two preparations of the sediment between slip and coverslip were used for each sample per children and observed under light microscopy with 20X and 40X magnification.

III. RESULTS

Among the 28 examined children, we identified infections by nematode helmhinh of the species Ascaris lumbricoides and Trichuris trichiura, the cestoid of the species Hymenolepis nana, as well as protozoa of the species Giardia lambia and Entamoeba coli. Positive cases occurred in five children (18.6%) of those examined.

IV. DISCUSSION AND CONCLUSIONS

Currently there are several diagnostic, treatment and prophylaxis resources for parasitic diseases. Even considering the exponential scientific and technological advances, parasitic diseases still figures as an important object of study and concern, especially in developing countries where researches prove the relation between precarious hygienic-sanitary conditions and poor quality of life of the population with parasitoses. Coproparasitological surveys carried out by several researchers show that microbial and parasitic diseases continue to be an important problem against population welfare as a worldwide health risk. The etiological agents of these diseases generally take advantage of environmental conditions, especially climatic conditions, and continue to affect essentially all age groups in various regions of the planet.

In Brazil, enteroparasitoses are included among the most worrying diseases, considering that such etiological agents affect humans and animals and are aided by ecological conditions. We observed that the micro-region of Manhuaçu also has favorable conditions for the permanence of parasitic agents in the environment and the transmission mechanisms for new hosts.

As well as in other developing countries, the spread of parasitic etiological agents in Brazil is further aggravated by socioeconomic conditions, especially due to the low level of education and the lack of knowledge or practice of good hygiene habits. The researchers Coura, Oliveira & Chiunchetta and Miorim-Moraes considered that the parasitized people have health damages and complications with reduction of the resistance of the organism and predisposition to infections to other pathogens. Regarding the children population, the authors affirmed that some parasitic agents may be responsible as aggravating factors of malnutrition, poor learning performance among schoolchildren, as well as lack of efficiency performance in workers, as possible consequences of natural indisposition due to parasitic diseases. We confirm the conclusions of these authors, emphasizing, however, that in the children hospitalized in the DAREI orphanage these problems apparently do not occur, perhaps due to the good general health of the children, the adequate food, the continuous assistance by professionals, permanent medical care, besides the orientation of the people who interacted directly with the children, what minimized the effects of microbial and parasitic infections.

Damásio et al. conducted a research on the prevalence of intestinal parasitoses among schoolchildren in the city of São Mateus, Province of Espírito Santo, Brazil. A total of 221 stool samples were analyzed and the results showed that 52.9% presented cysts or eggs from at least one intestinal parasite species. From the parasited people, 15.4% had polyparasitism and the most frequent association was Entamoeba coli and Entamoeba histolytica/dispar. The protozoa Entamoeba coli and Giardia lambia, and the helmhinh Ascaris lumbricoides and Ancilostomidae species were the most frequent parasites in the analyzed feces. Our results with children living at the DAREI orphanage presented a lower percentage than those found by the cited authors, probably due to the fact that they were isolated children with restricted exposure to the environment.

Andrade et al. conducted a research on the prevalence of intestinal parasitoses in children at the Municipal Infant Education Center of Campo Mourão, Province of Paraná, Brazil. They analyzed 32 fecal samples by the method of Faust and the method of Hoffmann, Pons & Janer, obtaining 25% positivity for enteroparasitoses. The registered parasites species were Giardia lambia, Endolimax nana, Entamoeba coli and Diphylidium caninum. The authors commented that the hygienic conditions were poor, the water was not filtered and the raw vegetables used for children lunch were washed only with tap water. Among the children, 73% lived with pets in their houses, justifying the presence of D. caninum, a dog’s parasite that is rarely diagnosed.

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in humans. These results differ from those found in children hospitalized at the DAREI orphanage, probably due to the different living conditions of the studied groups.

Considering the occurrences and the percentage of hospitalizations of residents in Manhuaçu by list of causes (ICD10), it is important to note that in year of 2010, 256 hospitalizations were registered for infectious and parasitic diseases, 5.2% of the total hospitalizations; in 2011: 195 hospitalizations (4.5%); 2012: 178 (5.2%). In 2012, with a total of 178 hospitalizations, being 93 were patients from less than one year to nineteen years old. These data shows an overview of infectious and parasitic diseases in the city.

This research contributed to identify the parasitic etiology affecting children living at the DAREI orphanage in the city of Manhuaçu. The results served as the basis for adequate prophylactic orientation and specific interventions to treat the found parasitic agents, in order to improve children's health and aiming to eradicate enteroparasitoses among the orphanage internships.

REFERENCES

Utilization of Obstetric Ultrasound Protocols among Sonographers in Five Selected Hospitals within Kampala District

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Abstract- Objective: To evaluate the availability, knowledge and utilization of obstetric ultrasound protocol among sonographers.

Design: Observational, descriptive, cross-sectional study.

Setting: Radiology departments in; Mulago National Referral hospital, Nsambya hospital, Kibuli Muslim hospital, Case hospital, Lubaga Mission hospital and Naguru hospital.

Participants: 32 Sonographers and radiographers who perform Obstetric ultrasound scanning.

Outcome measures: Availability of protocol manuals, knowledge on usefulness and conformity to the protocols.

Results: Only one of the five participating hospitals in Kampala had obstetric ultrasound protocol manuals on site. However, 81% of sonographers were aware of the existence of obstetric ultrasound protocols. Majority of sonographers (84.4%, 27/32) were knowledgeable about the importance of obstetric ultrasound protocols. Over half (56.3%, 18/32) of the sonographers reported that adherence to obstetric ultrasound protocols helped to achieve accurate diagnosis. Pregnancy localization was done by all participants while uterine wall survey for anomalies was least performed (28.1%, 9/32). Work overload was reported as the main reason for not following protocol all the time (31.3 %, 10/32) and Continuous Medical Education (CME) was suggested as the best way to improve protocol utilization.

Conclusion: Obstetric ultrasound protocols are lacking in most hospitals in Kampala. Despite the lack of protocols, sonographers were knowledgeable on the importance of obstetric protocols especially in regard to achieving accurate diagnosis. Most sonographers observed adhered to most aspects of the obstetric ultrasound protocols. Workload was reported as the main reason for not following protocols and CMEs were recommended by majority as best way of improving compliance to protocols.

Index Terms- Obstetric, Protocol, Sonographer, Ultrasound.

I. INTRODUCTION

Obstetric ultrasound protocols are professional standards that are used for systematic examination of pregnant mothers. Since introduction of ultrasonography in the late 1950’s, with subsequent publication of Protocols in 1996, ultrasound has become a very useful diagnostic tool in obstetric management (Woo, 2006). Internationally, utilization of obstetric ultrasound protocols has promoted safe and effective use of ultrasound in clinical medicine for more than 50 years as documented by the American institute of ultrasound in medicine (AIUM) in 2013.

Since the publication of the guidelines for professional working standards in 1996, service provision, technology and patient expectations in medical ultrasound have been transformed. These professional working standards are made available to sonographers to be used as guidelines for good practice (United Kingdom association of sonographers - UKAS,2008). Utilization of obstetric ultrasound protocols plays an important role in the examination of every pregnant woman. Protocols facilitate assessment of; fetal viability, number of fetuses, fetal age estimation and identification of fetal anomalies (Novakov et.al, 1999). Protocols also help in standardization of working procedures in radiology departments.

In 2015, new clinical working guidelines and obstetric ultrasound protocols were reviewed and published in Canada by the society of ultrasound in obstetrics and gynecology. The intentions of these standards were to ensure a uniform level of care among the sonographers thorough out Canada and other countries including Uganda (Prenatal Services BC. 2015). In Uganda, the ministry of health produced Standards on diagnostic and therapeutic radiology in 2012. However, conformity to these guidelines in Uganda is not known.

According to Geeta (2003), routine obstetric ultrasound in pregnancy is very important. She further explains when it should be done, how it should be done, who should perform it and how the report should be documented by sonographers. UKAS (2008) concurred with her document, all these findings emphasize the need for compliance to protocols.

In Africa and Uganda in particular the adherence to obstetric ultrasound protocols among the hospitals is not known. No published research work has been conducted to show the extent of conformity to Uganda’s Ministry of Health 2012 standards on diagnostic imaging and therapeutic radiology. It is upon this background that we conducted a study to establish the existence and utilization of obstetric ultrasound protocols in five selected hospitals in Kampala district and make necessary
recommendations to improve the quality of obstetric service provision.

II. MATERIALS AND METHODS

Observational, descriptive, cross-sectional study was conducted to assess utilization of obstetric ultrasound protocols among sonographers in five selected hospitals between July and August 2016.

The study employed various sampling techniques appropriate for each study objective.

a. To determine availability of obstetric ultrasound protocols - the researchers used purposive sampling technique to select five head of departments from the five selected hospital, since they were knowledgeable and were able to provide required information on and show evidence of availability of ultrasound protocols in their departments.

b. To assess the knowledge and utilization of ultrasound protocols, the researchers used stratified sampling technique to select sonographers in five selected hospital. Sonographers were grouped in various strata’s which in this study were the hospitals. The researchers then got the list of all sonographers in each hospital. To get the number of sonographers in each hospital (strata) to participate in the study, the following formula was used.

\[
\frac{\sum x}{N} = n \times f
\]

N=total study population in five hospitals.

n=study sample size.

f=total number of sonographers per hospital.

x=desired sample size per hospital.

After determining the sample size in each hospital, the researchers used simple random sampling technique to select the sonographers who participated in the study. Those selected were then observed by two independent observers while they performed an obstetric ultrasound scan. The observers completed a check list on utilization of obstetric ultrasound protocols while a standardized semi-structured questionnaire was used to assess their knowledge.

The data was collected by the five researchers in five hospitals on different days in a period of two weeks between July and August 2016.

Descriptive statistical analysis was performed with SPSS version 19.0 and results presented using frequencies, tables, charts and graphs.

The study was approved by Mengo Hospital Research and Ethics Committee (MHREC). Clearance to carry out the study was also sought from the respective hospital research committees. Participation was voluntary. The procedure and benefits of the study were explained to the participants. Each participant was provided with informed consent. To ensure confidentiality, code numbers instead of names of sonographer(s) and hospital on the questionnaire were used.

III. RESULTS

Availability of Obstetric Ultrasound Protocols

<table>
<thead>
<tr>
<th>Hospital Code</th>
<th>Number of respondents</th>
<th>Availability of protocol Manual</th>
<th>Knowledge on Importance of Obstetric Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>No</td>
<td>Yes, 4/4; No, 0/4</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>No</td>
<td>Yes, 4/6; No, 2/6</td>
</tr>
<tr>
<td>C</td>
<td>7</td>
<td>No</td>
<td>Yes, 5/7; No, 2/7</td>
</tr>
<tr>
<td>D</td>
<td>10</td>
<td>Yes</td>
<td>Yes, 8/10; No, 2/10</td>
</tr>
<tr>
<td>E</td>
<td>5</td>
<td>No</td>
<td>Yes, 4/5; No, 1/5</td>
</tr>
</tbody>
</table>

Table 2 above shows that only one hospital (1/5) was observed to have obstetric ultrasound protocol manual on site. It also demonstrated that knowledge on the importance of obstetric protocol was reported in all hospital; A 100%, (4/4), B 66.6% (4/6), C 71.4%, (5/7), D 80% (8/10) and E 80%, (4/5).
Level of knowledge of sonographers on the importance of obstetric ultrasound protocols

The study further ascertained the level of knowledge of sonographers on the importance of obstetric ultrasound protocols.

Figure 1: Level of knowledge of sonographers on the importance of obstetric ultrasound protocols

The study findings in figure 1 above show that the majority of the sonographers are knowledgeable about the importance of obstetric ultrasound protocols. Eighty four percent (27/32) were knowledgeable as compared to 15.6% (5/32) who reported that they are not knowledgeable about the importance of obstetric ultrasound protocols.

The sonographers were further probed on the level of knowledge on the specific importance of obstetric ultrasound protocols and the results are presented in table 3 below.

Table 3: Knowledge on Importance of Specific obstetric ultrasound protocols

<table>
<thead>
<tr>
<th>Knowledge on Importance of the protocols</th>
<th>Frequency(n=27)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate diagnosis</td>
<td>18</td>
<td>66.6</td>
</tr>
<tr>
<td>Detect fetal anomalies</td>
<td>16</td>
<td>59.2</td>
</tr>
<tr>
<td>Better patient management</td>
<td>4</td>
<td>14.8</td>
</tr>
<tr>
<td>Viability and position ascertainment</td>
<td>3</td>
<td>11.1</td>
</tr>
<tr>
<td>Patient satisfaction and confidence increased</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Reduced patient waiting time</td>
<td>2</td>
<td>7.4</td>
</tr>
<tr>
<td>Client acceptance</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Reduced patient referrals</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Ease of scanning</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Help to reduce acoustic shadow and artifacts</td>
<td>1</td>
<td>3.7</td>
</tr>
<tr>
<td>Allows standardization to reduce variations</td>
<td>1</td>
<td>3.7</td>
</tr>
</tbody>
</table>

*Summation greater than frequency since some participants were aware of more than one importance of obstetric ultrasound protocol.
The study findings in table 3 above show that the majority of the sonographers acknowledged that obstetric ultrasound protocols help to achieve accurate diagnosis 66.6%(18/27), detection of fetal anomalies 59.2%(16/27), better patient management 14.8%(4/27), viability and position ascertainment 11.1%(3/27) and reduced patient waiting time 7.4%(2/27). Other importances mentioned were; reduced patient referrals, ease of scanning, reduced acoustic shadow and artifacts and standardization to reduce variations.

Compliance to Obstetric Ultrasound Protocols

**Figure 2:** How often the recommended obstetric ultrasound protocols are followed by sonographers.

![Figure 2: How often the recommended obstetric ultrasound protocols are followed by sonographers.](image-url)

Figure 2 above shows that majority of sonographers (62.5%, 20/32) sometimes follow the recommended obstetric ultrasound protocols, while 31.3% (10/32) often follow the recommended obstetric ultrasound protocols, and only 6.3% (2/32) rarely follow the recommended obstetric ultrasound protocols.

**Table 4: Observations of compliance to obstetric ultrasound protocols by sonographers**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Frequency (N=32)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Trimester</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregnancy locations are done</td>
<td>32</td>
<td>100</td>
</tr>
<tr>
<td>Sonographer provides privacy to the patient</td>
<td>29</td>
<td>90.6</td>
</tr>
<tr>
<td>Fetus Viability is assessed</td>
<td>26</td>
<td>81.3</td>
</tr>
<tr>
<td>Early sign of pregnancy failure is noted and documented</td>
<td>25</td>
<td>78.1</td>
</tr>
<tr>
<td>Sonographer explains the procedure to the client</td>
<td>23</td>
<td>71.9</td>
</tr>
<tr>
<td>Sonographer introduce themselves to the client</td>
<td>17</td>
<td>53.1</td>
</tr>
<tr>
<td>Adnexa is surveyed</td>
<td>13</td>
<td>40.6</td>
</tr>
<tr>
<td>Uterine anomaly is assessed</td>
<td>11</td>
<td>34.4</td>
</tr>
<tr>
<td>Liver is used for setting gains</td>
<td>7</td>
<td>21.9</td>
</tr>
</tbody>
</table>
The results from the observation show that pregnancy locations were perfectly performed as an obstetric ultrasound protocol by 100.0% of participants. Relevant patient clinical information, placenta localization and maturity was performed by 96.9% of sonographers. Amniotic fluid volume quantification was documented by 81.3%(26/32) of respondents. Majority of sonographers (96.9%) observed infection control by cleaning probe after every patient. However, half of respondents reported that departments did not have enough changing gowns for all patients. Uterine wall survey for anomaly was poorly performed by only 28.1% and the liver was used for setting gains by only 34.4% of respondents.
Table 5: Reason for not following obstetric ultrasound protocols all the time.

<table>
<thead>
<tr>
<th>Reason for not following protocols all the time</th>
<th>Frequency (n=32)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workload</td>
<td>10</td>
<td>31.3</td>
</tr>
<tr>
<td>Emergency cases</td>
<td>3</td>
<td>9.4</td>
</tr>
<tr>
<td>Just ignored</td>
<td>2</td>
<td>6.3</td>
</tr>
<tr>
<td>Limited time for patients</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Ignorance</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Not significant</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Under motivation</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>No response</td>
<td>13</td>
<td>40.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Obstetric ultrasound protocols were not followed all the time due to: workload -31.3% (10/32), emergency cases-9.4%(3/32), just ignored-6.3%(2/32) while ignorance, limited time for patients, not significant and under motivation were each reported by a single participant. Forty percent (13/32) of the respondents did not respond to this question.

Table 6: Suggestion on how to improve utilization of obstetric ultrasound protocols.

The study further probed respondents on the ways of improving utilization of protocols among sonographers. The table below represents their various suggestions.

<table>
<thead>
<tr>
<th>Suggested ways of improving utilization of protocols in the hospital</th>
<th>Frequency (n=32)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continued Medical Education</td>
<td>15</td>
<td>46.9</td>
</tr>
<tr>
<td>Pining protocol in the room</td>
<td>3</td>
<td>9.4</td>
</tr>
<tr>
<td>Provision of protocol manual for sonographers</td>
<td>3</td>
<td>9.4</td>
</tr>
<tr>
<td>Awareness workshops/seminars/conferences</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Constant reminders, set rules, use of templates</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Emphasizing their use in the department</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Hiring more staff to reduce workload</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Policy formulation and enforcement</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Infection control</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Weekly Seminars with clinicians, midwives, conferences</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>No response</td>
<td>2</td>
<td>6.3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>32</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Continuous Medical Education was suggested by majority-46.9% (15/32) as the best way of improving utilization of ultrasound protocols followed by provision of protocol manual - 9.4%( 3/32) and Pining protocol in the room. Other suggestions included awareness seminars, constant reminders, hiring more staff to reduce workload and policy enforcement.

IV. DISCUSSION

The availability of obstetric ultrasound protocols in five selected hospitals in Kampala

The majority of hospitals did not have the protocol manual and only one hospital had the protocol manual on site. None of the hospitals had any of the obstetric ultrasound manuals pinned
on the wall or disseminated to sonographers. Despite the protocol manual being available in one hospital, it was not readily available for the sonographers to utilize and this might have contributed to some participant reporting that they are not aware of the importance of protocols. This is in contrast to Uganda MOH (2012) document which promotes the availability of obstetric ultrasound protocol manuals in all imaging departments in Uganda. Availability of protocols promotes its utilization as emphasized by Uganda MOH (2012) “protocols should be referred to and followed for all imaging investigations.”

The level of knowledge of sonographers on the importance of obstetric ultrasound protocols.

Majority of the sonographers are knowledgeable about the importance of obstetric ultrasound protocols. Being knowledgeable about the importance of obstetric ultrasound protocols is a positive attribute which encourages the sonographers to follow the obstetric ultrasound protocols.

Despite of obstetric manual not being available in four of the five hospitals, knowledge on the importance was reported in all hospitals. This implies that there is no significant correlation between availability of protocol manual and the knowledge on the importance of obstetric ultrasound protocols (Pearson chi-square 0.903, not in results).

The sonographers were further probed on the level of knowledge on the specific importance of obstetric ultrasound protocols and the more than half of the sonographers reported that obstetric ultrasound protocols help to achieve accurate diagnosis. This finding is in line with Steven et.al (1999) who reported that, protocols improve consistency of health care provision. In their study, they observed that patients with identical clinical problems received different care depending on the clinician/sonographer, hospital or location where protocols are not utilized as opposed to where they are utilized. Half of the respondents reported that obstetric ultrasound protocols help to detect fetal anomalies. This is in line with (Novakov et.al, 1999) who stated that protocols facilitate assessment of; fetal viability, number of fetuses, fetal age estimation and identification of fetal anomalies.

The utilization of obstetric ultrasound protocols by sonographers in five selected hospitals in Kampala

The majority of the sonographers reported that they utilize the recommended protocols when performing obstetric ultrasound. This is a promising trend for the sonographers and only needs to be further encouraged to improve on compliance to 100%.

We further assessed how often the recommended obstetric ultrasound protocols are followed by sonographers and we found that more than half of sonographers sometimes follow the recommended obstetric ultrasound protocols, while only a third often follow the recommended obstetric ultrasound protocol often and very few of them rarely follow the protocols. This is an indication that recommended protocols are to large extent followed by sonographers though not at all times. MOH (2012) reported that, adherence to proposed protocols increases the benefits ultrasonography offers in the management of obstetric patients and maximizes the possibility of detecting many fetal anomaly. Therefore obstetric ultrasound protocol should be easily accessible in all healthcare institutions to make it easier for them to be followed.

The study determined how various component of protocol was being observed by sonographers. Pregnancy location was observed by 100% (32/32) of participants. This is in line with (AIUM2013, SOGC2005 and UKAS, 2008) recommendation and should be maintained through rewarding strategies such as certificates of good performance. However, poorly performed were uterine wall survey and using liver for setting gain and so more emphasis should be ensured to improve compliance. In addition we assessed ways of improving conformity to protocols and Continued Medical Education (CME) was suggested by most participants. This was supported by ASA (2014) recommendation that, “relevant professional development should continue through a sonographer’s working life since science and technology develops and society changes.” Heads of radiology departments should encourage all sonographers to participate in CMEs on obstetric ultrasound.

Despite the fact that obstetric ultrasound protocols were lacking in most hospitals in Kampala, majority of the sonographers are knowledgeable about the importance of obstetric ultrasound protocols. Most of the sonographers acknowledged that obstetric ultrasound protocols aids in achieving accurate diagnosis. Most sonographers observed adhered to the recommended obstetric ultrasound protocols. Fetal localization was done by majority of sonographers. However, uterine wall survey for anomalies and use of the liver for setting gains was poorly observed by most sonographers.

Work overload was quoted by most participants as the main reason for not following protocols always. Continuous medical education was suggested by majority as the best way of improving compliance to protocols

Competing Interest

No competing interest declared

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Factors Influencing Level of Sexual Gender-Based Violence on Women in Border Towns in Uganda; A Case Study of Arua Municipality

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Abstract: Sexual gender based violence is still a problem in Uganda. With the different interventions to curb and or reduce SGBV, the levels of prevalence are varied due to the different factors. The purpose of the study was to determine the factors influencing level of sexual gender-based violence on women in border towns in Uganda. The study used mixed research design, stratified simple random sampling was used to select a sample of 123 respondents from a target population of 181 (youth, women, men, police, judiciary, cultural institutions and CSO’s). Primary data was collected using self-administered questionnaires, key interview and focus group guide, data was analyzed using percentiles, correlation and regression; descriptive and inferential statistics. The findings acknowledged SGBV existence in the municipality, 96.3% rated it highly. Respondents rated factors like drug abuse, peer influence and marital relations with over 80% directly having influence on the level of SGBV on women. The study revealed a moderate negative correlation between the law enforcement and the level of SGBV with a correlation coefficient of -.415**, implying improved legislation alone do not reduce SGBV on women. A significant positive association between drug abuse and level of SGBV was established with a correlation coefficient of .766**, which implies that an increase in drug abuse by one unit would lead to an increase in the level of SGBV by (r2) .59 units. Peer influence was very substantially related to SGBV at .530**; and therewas no significant correlation between marital relations and level of SGBV at .086. Marital relations, policies, peer and drug abuse accounted for 63% (R Square, 0.633) of the variation in SGBV with an F value of 32.812 establishing a significant relationship. Government of Uganda should deliberately employ system-wide approaches to enforce laws; control the drug movement and consumption; develop programs that promote civic engagement and should do this in partnership with CSO’s, private institutions and communities.

Key words: Sexual violence, gender-based violence, violence against women, gender, violence

Introduction
Violence has always been part of the human experience. Today, violence results in more than 1.5 million people being killed each year, and many more suffer non-fatal injuries and chronic, non-injury health consequences as a result of suicide attempts, interpersonal violence (youth violence, intimate partner violence, child maltreatment, elder abuse and sexual violence) and collective violence. Overall, violence is among the leading causes of death worldwide for people aged 15–44 years (Krug et al., 2002).

The feminist movement that sprung out of the civil rights and peace movements in 1967-1968 viewed the oppression of women as the most fundamental form of oppression and violence, one that cuts across boundaries of race, culture, and economic class. The United Nations Declaration on the Elimination of Violence against Women describes violence against women as;

"A manifestation of historically unequal power relationships between men and women. At the same time, violence is used to perpetuate and enforce women's subordinate role. In the Declaration on the Elimination of Violence against Women, the United Nations and its member countries denounce sexual gender based violence as one of the "crucial social mechanisms by which women are forced into subordinate positions compared with men."

Sexual gender-based violence (SGBV) is a worldwide sickness and it happens every day in homes, communities, and work related places, religious institutions and even law enforcement institutions. According to 2013 global review of available data, 35 per cent of women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence. However, some national violence studies show that up to 70 per cent of women have experienced physical and/or sexual violence in their lifetime from an intimate partner. All survivors of SGBV, despite their social-political status are entitled to protection, justice and rehabilitation (Goma Declaration by ICGLR, 2008).
Violence against women - particularly intimate partner violence and sexual violence - are major public health problems and violations of women’s human rights. Global estimates published by WHO indicate that about 1 in 3 (35%) women worldwide have experienced either physical and/or sexual intimate partner violence or non-partner sexual violence in their lifetime. Most of this violence is intimate partner violence. Worldwide, almost one third (30%) of women who have been in a relationship report that they have experienced some form of physical and/or sexual violence by their intimate partner in their lifetime. Globally, as many as 38% of murders of women are committed by a male intimate partner. Violence can negatively affect women’s physical, mental, sexual and reproductive health, and may increase vulnerability to HIV. Factors associated with increased risk of perpetration of violence include low education, child maltreatment or exposure to violence in the family, harmful use of alcohol, attitudes accepting of violence and gender inequality (WHO, 2016). Half of countries in developing regions report a lifetime prevalence of intimate partner physical and/or sexual violence of at least 30%. Prevalence is generally high in Africa, with one quarter of countries in the region reporting prevalence of at least 50% (UN, 2015).

The Uganda Demographic and Health Survey (UDHS) of 2006 indicated that 60% of women aged between 15 and 49 have suffered physical violence, 39% of women have suffered sexual violence, while 16% have experienced violence during pregnancy. However, comparatively according to the Uganda Demographic and Health Survey (2011), GBV prevalence rates stand at 56 percent for Physical violence, 27.7 percent for Sexual violence and 42.9 percent for spousal emotional violence. On average, 63% of the women in Uganda had experienced physical or sexual violence or both in their lives.

Problem Statement
Violence against women is a manifestation of the historically unequal power relations between men and women, fundamentally related to gender-based inequalities, which both lead to and result from violence against women, in a vicious cycle (Jennifer et al., 2011). Sexual and Gender-Based Violence (SGBV) was identified by the 1995 Beijing Declaration and Platform for Action and several international conventions as an obstacle to the achievement of the objectives of equality, development and peace. Sexual gender-based violence and exploitation is a crime (Goma Declaration, 2008). It represents a serious threat to national and regional peace and security, and increases the propagation of HIV/AIDS. Thus, the State has a duty to protect its citizens from all forms of human rights violations, including SGBV, since its cost on the economic and sustainable development of a country is very high. Sixty-eight (68) percent of ever-married Ugandan women aged 15 to 49 years have experienced some form of violence inflicted by their spouse or intimate partner (UBS, 2007). A study by the Uganda Law Reform Commission (2006) revealed that 66% of both men and women respondents had experienced domestic violence (CEDOVIP, 2007). The Uganda Police Annual Crime and Traffic/Road Safety Report (2013) indicate that sex-related crimes, in particular defilement, are not decreasing with 9,589 cases compared to 8,076 cases in 2012. Domestic violence also increased by 18.4% from 2,793 cases reported in 2012 to 3,426 cases reported in 2013.

To ensure the protection of women and girls from sexual gender-based violence, particularly rape and many other forms of sexual abuse, the Uganda Government has developed favorable policies, laws and has ratified different international treaties and instruments to address this. One key instrument Uganda signed is the Goma Declaration which consequently recognizes that the struggle to end SGBV entails a combined effort of men, women, boys and girls, and all state institutions and thus calls upon different parties, including governments, international agencies and Civil Society Organization, to jointly work together to eradicate all forms of gender-based violence. Furthermore, the Uganda Police Force established a Gender Desk in 1986, which became the Child and Family Protection Unit (CFPU) in 1989 (CEDOVIP, 2007).

Arua municipality has a unique setting; it borders Eastern DRC and Southern Sudan. This kind of setting comes with its challenging uniqueness for aggravated SGBV and opportunities to respond to such crimes. The porous borders encourage crime flow from one country to the other and among the crimes are the sexual related violence’s which mainly victimizes women and girls. As a refugee hosting border town, several interventions have been put in place by government of Uganda, CSO’s and other developing partners to help redress and reduce cases of SGBV in Arua town.

Purpose
The aim of the study was to determine the factors influencing level of sexual gender-based violence on women in border towns in Uganda. Specifically the study sort to ascertain the influence of the existing policies/laws, drug abuse/ alcoholism, peer influence and marital relations on the level of SGBV on women in border towns in Uganda.

Methodology
The study used mixed research design, stratified simple random sampling was used to select a sample of 123 respondents from a target population of 181 (youth, women, men, police, judiciary, cultural institutions and CSO’s). Primary data was collected using self-administered questionnaires, key interview and focus group guide, data was analyzed using percentiles, correlation and regression; descriptive and inferential statistics.

Results and Analysis
The study findings revealed that 64.2% of the respondents disapproved the statement that law and policies have a strong influence on the level of SGBV on women. 83.9% agreed that there are adequate laws and policies put in place by the government of Uganda however, they are not effectively implemented to address issues of SGBV on women. Further discussions revealed that
much as these laws are put in place, they remain unknown to the people, 96.3% of the respondents disagreed with the statement that community members are knowledgeable of these laws. The limited awareness and knowledge on the laws and policies, and interpretation of such laws in the community is a huge challenge and therefore such cases usually remain in the hands of family heads or community/cultural leaders. 95% of the respondents did not believe that institutions handling such cases respond on time and give justice as required and because of this, most respondents believed reporting such cases to police and seeking court justice is a waste of time and resources.

Issues of corruption came out clearly as a challenge to seeking justice and redress to victims of SGBV in Arua Municipality. According to respondents who work in the judiciary, a few cases reach out to court and yet they rely on the police to get the evidences needed to prosecute such perpetrators of the crime of SGBV. The study further revealed that 40.7% of women compared to 20.1% of men do not believe that law enforcement has a strong influence on the level of SGBV on women in Arua Municipality. Therefore, there is need for a lot of sensitization on the existing laws and policies and more efforts to enforce the implementation of these laws and policies to prevent, address and respond to crimes of SGBV in the municipality.

The study revealed a moderate (Davis, 1979) negative correlation between the two variables; r = -0.42, n = 81, p = 0.001. The findings agree with those of Ellsberg, Arango & Morton, (2014) which found that training and improved legislation alone do not improve outcomes for women or reduce violence at a community level, and that system-wide changes are needed to improve the enforcement of laws. Further, 83.9% acknowledged that drug abuse and alcoholism has a strong influence on the level of SGBV on women and only 16% of the study respondents did not agree with the statement (Figure 4.5). 87.7% of the respondents agreed that most perpetrators act under the influence of drug abuse and alcoholism, 58.1% agreed that crimes of SGBV occurs in bars and drug abuse places, 65.5% agreed that most parents who marry off young girls are drunkards. The findings also show that 77.8% of the study respondents approved that alcohol and drug abuse is the main cause of SGBV on women in Arua Municipality. However, to the respondents who disagreed, there are a number of factors that lead to SGBV in Arua Municipality and some of them included poverty, high level of illiteracy, parental negligence and negative cultural and religious practices like child marriages. 87% of the respondents did not accept that women abused are found drunk or under the influence of drugs. According to the respondents, most perpetrators do not just respect women; they see women as sex objects to use as they wish. It’s therefore, more of a cultural practice of devaluing women than an influence of drug abuse/alcoholism.

The results of Pearson correlation indicated that there was a significant positive association between drug abuse and level of SGBV; r = 0.77, n = 81, p = 0.001. This shows that an increase in drug abuse by one unit would lead to an increase in the level of SGBV by (r^2) .59 units. This means that drug abuse explains 59% of the sexual gender based violence occurrences. Data from the WHO multi-country study on women’s health and domestic violence showed that across countries alcohol use was a robust correlate with experiences of violence (Abramsky et al., 2011).

On the role of peers in influencing the level of SGBV on women, 87.7% of the respondents recognized that peers have a strong influence on the level of SGBV on women in Arua Municipality. 64.2% of the respondents agreed perpetrators act under influence of peers, 53% of the female respondents highly acknowledged that peer pressure has a strong influence on the level of SGBV as compared to their male counterpart, to them peers influence a lot on how they handle issues of reporting, response among themselves. Women tend to discourage their peers from reporting such evils against them because of cultural believes, unreliable response and support from police and limited justices attained through the court system.

Further, 34.5% of the men who agreed that peers have a great influence on the level of SGBV on women reported that many men act under peer pressure to sexually abuse their girlfriends and wives, men discuss on their evil strategies, they plan, implement.
them and give feedback and rate themselves as achievers or losers. From the correlation results, peer influence was very substantially related to SGBV; $r = .53$, $n = 81$, $p = 0.001$, this show that an increase in peer influence by one unit would increase SGBV by .28 ($r^2$) or 28%. DeKeseredy and Schwartz (1998) argue that male peer support groups encourage and justify sexual violence against women and actually create opportunities for their group members to engage in sexual violence against women. The study also assessed the role of marital relations in influencing the level of SGBV on women. The findings revealed that 91.3% approved that marital relations have an influence on the level of SGBV on women, 86.4% confessed that SGBV on women are perpetrated by intimate partners, 87.6% agreed that Perpetrators of SGBV are family members, partners/ ex-husbands/boyfriends. 70.4% of the respondents strongly agreed that women forced to marry face SGBV more than women who willingly get married to their husbands out of love.

Majority of the respondents (76.5%) disagreed with the contention that single women face SGBV more than married women. Respondents further confessed that married women are prone to SGBV because they are subject to men’s abuse most times. A married woman has no place in her father’s house, the cows the in laws give is enough to sell her position and therefore has a belonging in her husband’s house. He the husband can choose to make use of her and discipline her as he wishes, this is influenced by the negative cultural believes and practices. In general, the findings statistically revealed that there was no significant correlation between marital relations and level of SGBV, $r = .77$, $n = 81$, $p = 0.001$ contrary to the previous studies which reported significant results. Klugman (2017), reports that marital relationships are an aggravating factor for the crimes of rape and sexual assault that includes elements of rape, or if the law sets out conditions in which the penalty for marital rape or rape by the husband is mitigated so that the criminalization of marital rape can be inferred.

Collectively all the respondents agreed that SGBV existed in the municipality; 38.3% rated it very high, 58% rated it high and 3.7% rated it low and none rated it very low (Figure 2). A number of the respondents who rated the level low justified that because of the low reporting rate and limited evidences which can be proved in the courts of law makes it difficult to prove hence remains a rumor. The study further revealed that 92.6% of the respondents confessed that most women in Arua Municipality have ever experienced SGBV, to them this includes women of all ages, education level and marital status. 97% (32.1% agreed and 65.4% strongly agreed) of the respondents recognized that teenage pregnancy is on the rise in Arua Municipality and 95.1% testified increased cases of defilement in the last ten years in the municipality.

Further, 67.9% of the respondents strongly agreed and 29.6% agreed that few cases of SGBV are reported to police. Most respondents justified the reason for failure to report such cases to police to the loss of trust victims have in the law enforcement institutions and the failure to get appropriate justice, redress and limited provision of protection of victims from perpetrators by such government institutions.

The study revealed, marital relations, policies, peer and drug abuse accounted for 63% (R Square, 0. 633) of the variation in SGBV (Table1).

![Figure 2: The level of SGBV in Arua Municipality](image)

**Table 1: Pearson Correlation for Model Variables**

<table>
<thead>
<tr>
<th>Level of SGBV</th>
<th>Marital relationship</th>
<th>Peer Influence</th>
<th>Drug Abuse/Alcoholism</th>
<th>Policies/Laws</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.086</td>
<td>.530**</td>
<td>.766**</td>
<td>-.415**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.447</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
</tbody>
</table>
The study further concludes that marital relations have no significant correlation with the level of SGBV, much as the respondents in Arua Municipality. Which give men power over women, the negative cultural practices and believes that upholds masculinity promotes SGBV on women. Drug abuse and level of SGBV were positively correlated; implying that an increase in drug abuse/alcoholism significantly lead to an increase in the level of SGBV. The rate of drug abuse and alcoholism in Arua Municipality is high and most perpetrators of SGBV are under the influence of drugs and alcoholism and or use it to boost their boldness to commit such a crime, drug control and management is a huge challenge in a municipality that borders two countries with porous borders and high refugee influx. Most women who are victims of SGBV were not under influence of alcohol but subjects to their male counterparts that society places to be superior over them.

Drug abuse and level of SGBV were positively correlated; implying that an increase in drug abuse/alcoholism significantly lead to an increase in the level of SGBV. The rate of drug abuse and alcoholism in Arua Municipality is high and most perpetrators of SGBV are under the influence of drugs and alcoholism and or use it to boost their boldness to commit such a crime, drug control and management is a huge challenge in a municipality that borders two countries with porous borders and high refugee influx. Most women who are victims of SGBV were not under influence of alcohol but subjects to their male counterparts that society places to be superior over them.

The study also concludes that peers have a strong negative effect on perpetrators of SGBV on women, they encourage themselves to commit such heinous crimes against women. Peers promote victims to tolerate SGBV and suppress reporting of crimes of SGBV hence affecting response to such cases. Peer behaviors are also influenced by the negative cultural believes and practices which give men power over women, the negative cultural practices and believes that upholds masculinity promotes SGBV on women in Arua Municipality.

The study further concludes that marital relations have no significant correlation with the level of SGBV, much as the respondents highly rated that perpetrators of SGBV are close and intimate relations. However, they were of the view that there are other driving factors like negative cultural practices, poverty, illiteracy that drives perpetrators to commit such crimes against women in the municipality. Women who never got involved into close intimate relations were also sexually abused regardless of their age and educational background. Rape and sexual assaults were mainly reported by single women and young girls.

Recommendations
Putting in place laws and policies is not adequate enough to address the problem of SGBV on women, the Government of Uganda should make deliberate efforts to enforce and or implement these laws and policies to specifically respond to sexual gender based violence (SGBV) on women. Government of Uganda should further strengthen the law enforcement institutions and their roles in implementing the laws/policies through allocating sufficient funding, continuous trainings and close monitoring of the institutions in order to achieve their mandates.

Need for a continuous sensitization and education of the citizens/community members on the existing laws and policies by Government of Uganda and Civil Society Organizations. This will make communities to appreciate the laws/policies, monitor their implementation, protect the right of the vulnerable in the community and apprehend law breakers/ perpetrators of SGBV. A community that is knowledgeable of the existing laws and policies that govern them is a vibrant community that is able to demand for accountability, protect their rights and take responsibility for their actions.

Civil society organizations, development partner, agencies and government institutions should develop programs and interventions to respond to the problem of SGBV, such programs will directly address issues of SGBV prevention, protection, response management and advocacy. The local governments should stringently control drug and alcohol movement and usage across the porous borders of Arua municipality which serves as a threat to drug movement and control. At district and sub-county levels, drug and alcohol movements should be strictly controlled to eliminate the supply chain of the drug trade.

ANOVA test was also conducted to determine whether the model worked in explaining the relationship among variables as postulated in the conceptual model and the results showed an F value of 32.812 with a significance level of 0.000 which is far lower than the confidence level of 0.05, hence establishing a significant relationship. The implication is that each independent variable contributed significantly to changes in the dependent variable. Multiple regression analysis results indicated that an increase in policies and marital relations by one unit would lead to a reduction in sexual gender based violence occurrence by .024 and .035 respectively. Further still, an increase in peer influence and drug abuse by one unit would lead to an increase in sexual gender based violence occurrence by .079 and .196 units respectively. It is worth noting that drug abuse and peer influence were the only significant predictors of SGBV. The regression model was summarized as; SGBV = -.616 -.024 (laws/policies) + .196 (drug abuse/alcoholism) + .079 (peer influence) - .035 (marital relations).

Conclusions
The level of Sexual gender-based violence on women in Arua Municipality is high. This is reflected in the high percentages indicated by respondents, most women and girls have at least experienced SGBV in their lifetime, the high teenage pregnancy rates and defilement rates indicated in the findings. Marital relations, policies, peer and drug abuse account for a high percentage of the variation in SGBV.

Policies and law enforcement and Level of SGBV were moderately correlated though improved legislation alone does not improve outcomes on reduction in SGBV on women at all levels, and that system-wide changes are needed to improve the enforcement of laws. Much as policies and laws have been put in place by the government of Uganda, very few community members are knowledgeable of them and the enforcement of these laws and policies is still a huge challenge and therefore has very little effect in preventing SGBV and responding to cases of SGBV effectively. Communities and SGBV victims have little trust in law enforcement institutions like police and the judiciary due to high corruption, delays in giving justice and the tedious and expensive and heinous process of gathering evidences and seeking justice for the crime of SGBV.

Drug abuse and level of SGBV were positively correlated; implying that an increase in drug abuse/alcoholism significantly lead to an increase in the level of SGBV. The rate of drug abuse and alcoholism in Arua Municipality is high and most perpetrators of SGBV are under the influence of drugs and alcoholism and or use it to boost their boldness to commit such a crime, drug control and management is a huge challenge in a municipality that borders two countries with porous borders and high refugee influx. Most women who are victims of SGBV were not under influence of alcohol but subjects to their male counterparts that society places to be superior over them.

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Civil society organizations, development partner, agencies and government institutions should develop programs and interventions to respond to the problem of SGBV, such programs will directly address issues of SGBV prevention, protection, response management and advocacy. The local governments should stringently control drug and alcohol movement and usage across the porous borders of Arua municipality which serves as a threat to drug movement and control. At district and sub-county levels, drug and alcohol movements should be strictly controlled to eliminate the supply chain of the drug trade.
level, the local government should develop bi-laws and ordinances to manage communities on issues of drug abuse and severely punish drug abuser in the community.

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Effective Use Of Mobile Learning Technology On The Students' Achievement Of The Faculty Of Applied Sciences In The Course Of Computer Basics And Retention Of Information.

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Abstract- It Is Noted That The Modern Mobile Learning Technology Has Become In The Present Time Occupies A Large Position Because Of Its Small Size And The Possibility Of Carrying Easily And All Areas Of Our Lives Have Been Able To Benefit From The Applications Of This Technology And The First Of These Areas Is The Educational Field. Because It Is An Environment Where Students Receive Lectures And Lessons Through The Use Of Mobile Phones, Which Do Not Need Effort Or Use A Special Environment Because They Are Not Specific To A Specific Place Or Time.

That The Use Of Mobile Devices In The Educational Process Makes It Easier For Teachers And Students To Do Their Own Duties, Which Leads Us To Believe In The Importance Of Using These Devices In The Educational Process. In This Area, The Current Research Aims To Identify The Effectiveness Of The Use Of Mobile Learning Technology, In This Area, The Current Research Aims To Identify The Effectiveness Of The Use Of Mobile Learning Technology On The Achievement Of Students In The Faculty Of Applied Sciences In The Course Of Computer Basics And Retention Of Data.

The Sample Of The Research Consists Of (36) Students From The First Stage In The Department Of Pathological Analysis At The Faculty Of Applied Sciences At University Of Samarra For The Academic Year (2016-2017). They Are Divided Into Two Groups (Experimental And Control), Which Are Equal In Number And Variables That May Affect The Integrity Of Experimental Design Of The Research.

The Researcher Has Chosen Four Topics From The Curriculum Of Computer Basics In The Faculty Of Applied Sciences, University Of Samarra (Evolution Of Computer Generations, Computer Components, Computer Safety, Operating Systems). The Teaching Objectives Of Each Of These Topics Were Determined In Light Of The Objectives Of Teaching The Course, The Researcher Also Prepared The Research Results, Which Is An Investigation Test Prepared By The Researcher Consists Of (40) Question, Including (20 Questions Of The Type Of Multiple Choice), And (20 Questions Of The Type Of Correctness And Errors) Has Been Calculated Validity And Reliability Of This Test Using Suitable Statistical Methods And Then The Teaching Process Has Begun For The Two Groups During The Second Semester (2016-2017) Where The Researcher Is Taught The Two Groups In Order To Reduce The Impact Of External Variables On The Results Of The Research, Where The Two Groups (Experimental And Control) Are Studying The Subject Of The Course Of Computer Basics In The Usual Way (Lecture) At The Same Time, And Then The Teacher Has Sent Additional Information And Explanation And Video Clips And Audio Video Of The Material That Is Explained In The Lecture To The Students Of The Experimental Group Using The Viber Program Through The Teacher's Mobile Device To The Mobile Devices Of The Students Of The Experimental Group While No Additional Material And Explanatory Materials Are Sent To The Control Group And The Trial Lasted For Four Weeks, Then, The Final Test Has Applied On The Students Of Both Groups At The Same Time.

After (Three Weeks) On The First Application The Same Test Has Returned To The Students Of The Two Groups Together Without Giving Them Any Advance Information On The Date To Be A Test On Retention Of Information Among Students Of The Two Groups, The Second Test, Pearson Correlation Coefficient, Mono-Variance Analysis, And Other Statistical Methods Are Used To Arrive At The Research Results.

The Research Finds That The Experimental Group That Uses Mobile Learning Technology Using The Viber Program Is Superior To Using The Mobile Phone On The Control Group That Did Not Use Mobile Learning Technology. In Light Of This, The Researcher Concluded The Effectiveness Of The Use Of Mobile Learning Technology In Increasing The Academic Achievement Of The Experimental Group Students And Retaining Information For Them For Longer.

Index Terms- Mobile Learning, Learning Achievement, Information Retention

I. INTRODUCTION

The World In Which We Live Today Is Witnessing A Wide Range Of Challenges And Developments, Which Encompass All Fields, Economic, Educational, Educational And Technological Aspects, Which Have A Great Impact On Our Lives, Especially In Terms Of Human Knowledge. The
Technological And Scientific Development Has Helped To Introduce The Era In Which We Live In The So-Called Mobile Era, Where Modern Technological Technologies Are Transferred To The Human Hand And Are Placed In The Pocket And The Forefront Of These Technologies Comes Mobile Device As Well As Tablet Computers, Which Spread Very Widely Among Learners And Users.


Mobile Learning Is A Major And Unprecedented Development Through The Provision Of Education To Students And Students Around The World. This Is Achieved Through The Use Of Mobile Phone, Which Is One Of The Most Popular And Popular Means Of Communication Nowadays. This Device Can Be Owned By The Vast Majority Of Students And Learners. At Most Levels, It Started From The Preparatory Stage To The University Stage, And In Different Forms And Models With Advanced Potential (Lal, 2011:161).

The Technology Of Mobile Learning Is Characterized By The Ability To Raise The Efficiency Of The Educational Process For Students And Learners Because It Can Save Time And Effort For The Student And Teacher, It Also Helps In The Use Of New Methods In The Teaching Process Commensurate With Individual Differences Between Students And Learners, As Mobile Learning Technology Allows The Student Or Learner To Choose The Method Or Method That Suits His Or Her Abilities, The Use Of This Technology Eliminates The Routine And Boredom Of The Learning Process. Mobile Technologies Enhance Interaction And Collaboration Between Students And Promote Self-Reflection Of Students And Learners, Helping To Improve The Learning Environment (Lan & Tsai, 2011).

Fuller And Joynes (2015: 158) Show That The Use Of Smart Phones And Tablets In Primary And Secondary Education Is Growing. This Is Reflected In The Fact That Students Have Special Skills In Using Smart Phones At The University Level. Today's Students Are Different From Students In The Past, Because They Have Modern Communication Devices That Help Them Communicate With Their Professors And Colleagues Anytime, Anywhere.

Mobile Technology Is One Of The Most Widely Used Technologies Today, It Is Considered One Of The Best Devices That Can Be Used In Mobile Learning, As They Can Provide A Large Number Of Services For The Educational Process And The Most Famous Of These Services: Access To The Internet, Sending And Receiving E-Mail Messages, Browsing And Viewing Various Sites, Running Files, Programs And Various Educational Courses (Amin And Al-Halawi, 2008).

Note That Many Educational Institutions And Universities Have Taken Upon Themselves The Official Use Of Mobile Learning In The Teaching Of Courses And Programs, Many Educational Institutions Have Effectively Implemented Mobile Learning Technology For All Their Students Through An Integrated System Such As A Blackboard System That Enables Students To Communicate With Their Peers, Teachers And Their Courses (Al-Ghudan, 2012).


Therefore, University Officials And Educational Institutions Should Modify Their View Of The Natural Use Of Mobile Learning Technology, Which Includes Mobile Phones And Tablet Computers, From Using These Devices To Make Phone Calls To The Greatest Benefit Of Teaching And Learning. Thus, The Great Benefit To Students And Learners As Well As Training In Terms Of Reducing Time And Effort As Well As Non-Adherence To Place And Time.

That The Interest In Teaching Computer In The Stimulation Of The Role Of The Student And Make It Active And Vital In The Educational Process, And Help Him Overcome The Weakness Resulting From His Lack Of Experience In Special Skills In The Use Of Computers.

The Researcher Believes That The Computer Is An Important Curriculum Because It Has Direct Contact With Human Needs, So It Is Best To Use Modern Teaching Methods That Help Students Learn To Use The Computer And Its Skills, Especially As The Methods Used In Teaching Computer Is Still Old And Ineffective.

Based On The Above, The Researcher Believes That Through The Use Of Modern Technology In Teaching The Basics Of The Computer And The Use Of Mobile Learning Technology, This Creates An Attractive Learning Environment That Is Attractive To The Students Of The Department Of Pathological Analysis In The Faculty Of Applied Sciences At The University Of Samarra So That The Students' Progress In Their Studies According To Their Abilities And Abilities. This Will Increase Their Academic Achievement In A Computer Course.

Chapter 1: Definition Of Research:

First: Statement Of The Problem:

The Current Century Has Witnessed A Great And Rapid Renaissance In Modern Technological Innovations Which Led To The Interest Of Educators In Pursuing These Techniques In Order To Benefit From Their Own Data And To Employ These Techniques In The Development Of Students And Learners. The Mobile Devices Are Among The Most Advanced Technological Technologies That Educational Teachers Seek To Benefit From.
In Educational Processes. The Reason For The Rapid Spread Of Mobile Devices Is To Increase The Storage Capacity Of These Devices, Allowing Them To Operate And Store Different Educational Programs And Applications. Where The Development Of Files Containing Lectures And Educational Programs Can Be Read And Viewed Through Mobile Devices, And This Helps To Reach Large Numbers Of Students And Learners In Different Places And At The Same Time. It Is Therefore Easy To Manage Part Of The Educational Process For Large Numbers Of Students, Learners And Trainees In A Simple And Reasonable Material Cost. It Should Be Noted That The Use Of Mobile Learning Devices As A Tool In The Educational Process Requires Us To Determine The Services And Benefits That You Want To Use For Participants In The Educational Process, And We Must Identify The Difficulties And Challenges In The Use Of These Devices In Educational Institutions.

The Current Research Aims To Find A Suitable Method Used In Teaching Computer Fundamentals That Are Suitable For Students And Attract Them Towards The Computer. This Is The Method Of Using Mobile Learning Technology To Help Increase The Achievement Of Students Of The First Stage In The Faculty Of Applied Sciences In The Course Of Computer Basics.

Second: - The Aim Of The Research:

1. Helps To Provide An Effective Teaching Method That Saves Time And Effort For The Teacher And Student.
2. Works To Strengthen The Spirit Of Cooperation And Self-Reliance For Students.
4. To Keep Abreast Of The Contemporary Trends In Order To Benefit From The Modern Technology Of Mobile Learning And To Employ Them In Teaching Science In General And Computer In Particular, As Well As Work On Updating The Educational Reality Of Universities And Educational Institutions Through The Use Of Mobile Devices For Students In The Educational Process, Attract Students' Attention.

Third: Limits Of The Research:

- Spatial Boundaries: University Of Samarra / Faculty Of Applied Sciences.

Fourth: Method Of Research: The Researcher Used The Method Is Similar To The Experimental To Suit The Objectives Of The Research.

Fifth: Research Objectives:

This Research Aims To Identify The Impact Of The Use Of Mobile Learning Technology In Increasing The Academic Achievement In Computer Basics For The Students Of The First Stage In The Faculty Of Applied Sciences At The University Of Samarra.

Sixth: The Hypotheses Of Research

1. There Are No Statistically Significant Differences At The Level Of Significance (0.05) Between The Mean Of The Experimental Group And The Average Score Of The Students In The Control Group In The Final Achievement Test.
2. There Are No Statistical Differences At The Level Of (0.05) Between The Mean Scores Of The Experimental Group And The Average Score Of The Control Group Students In The Retention Test Of The Information Of The Computer Basics.

Seventh :The Terms Of Research

1- Effectiveness:

- Zaytoun (2002: 54) Defines Effectiveness As "The Ability To Influence And Achieve Goals Or Inputs In Order To Achieve The Desired Results And Reach As Far As Possible."

- The Researcher Defines Procedural Efficiency As: The Ability Of Mobile Learning Technology To Influence The Achievement Of Students In The First Stage In The Faculty Of Applied Sciences In The Course Of Computer Basics As A Result Of The Use Of Mobile Learning Technology In The Current Research.

2- Mobile Learning:

- Keskin & Metcalfe (2011: 20) Define Mobile Learning As A Pattern Of E-Learning That Can Happen Anywhere Or At Any Time Through The Use Of A Mobile Device Such As A Mobile Phone Smartphones, Tablet Pc, Pda, Or Any Other Portable Device.

- Santosh (2013) Defines Mobile Learning As An Expression Of The Freedom Of Education For Students And Learners Through The Use Of Mobile Technology By Providing Students, Learners And Trainees With The Information They Need Anywhere, At Any Time.

- Al-Shaya, Al-Obeid( 2015):Define Mobile Learning As The Process By Which Mobile Devices, Such As Tablets And Smart Phones, Are Used To Enable Students And Learners To Learn Anywhere And Anytime, And Thus To Have An Educational Experience Characterized By Authenticity And Realism.

- The Learner Defines Mobile Learning As An Educational Process: It Is An Environment In Which The Process Of Teaching And Learning Is An Interactive Learning Environment That Is Not Specific In A Specific Time Or Place, Providing The
Student And Learner The Ability To Education And This Through The Use Of Mobile Phones, Tablet Pcs And Other Mobile Devices.

- Procedural The Learner Defines Mobile Learning As An Educational Process: It Is An Environment In Which The Process Of Teaching And Learning Is An Interactive Learning Environment That Is Not Specific In A Specific Time Or Place, Providing The Student And Learner The Ability To Education And This Through The Use Of Mobile Phones, Tablet Pcs And Other Mobile Devices.

3. Achievement:
- Al-Akhal (2004): Defines It As The Amount Of Knowledge, Information And Skills That Students Obtain, And The Grades In The Tests Designed For This Purpose, As A Result Of Their Study Of A Specific Subject, Program Or Educational Unit.
- Procedural The Researcher Defines It As: The Amount Of Knowledge And Information Obtained By The Students Of The First Stage In The Faculty Of Applied Sciences After The Study (Four Topics Of The Curriculum Of Computer Basics) Estimated The Degrees Obtained By Students In The Test Prepared By The Researcher.

The Second Subsection: The Theoretical Framework And The Previous Studies:

First: Theoretical Background: Mobile Learning:

1- The Concept Of Mobile Learning:

2- Characteristics Of Mobile Learning:
Mobile Learning Is Characterized By A Number Of Important Characteristics. These Are The Characteristics Of (Fatouhi-Ghazvini Et Al, 2011:21) And (Mahdi, 2014: 47):

1. Education Administration: Mobile Learning Facilitates The Management And Direction Of The Learning Process And Helps In The Management Of Research And Meals Remotely Using Smart Phones And Tablet Pcs For Mobile Learning.

2. Save Time Teaching: That Mobile Learning Provides The Learner Time And Effort, Where The Student Or Learner Can Relay Information And Questions, Very Quickly Remotely And At The Same Time, And This Provides The Learner A Lot Of Time And Effort.

4. Course Of Computer Basics: It Is One Of The Subjects For The Students Of The First Stage In The Faculty Of Applied Sciences At The University Of Samarra And Three Hours A Week And Aims To Teach Students The Basics Of Computer Use.

5. Information Retention:

3. Availability: Mobile Learning Goes Beyond The Boundaries Of Space And Time. It Does Not Adhere To The Boundaries Of Classrooms And Can Extend With The Extension Of The Wireless Network. This Provides More Freedom For The Education Of Students, So That The Process Of Education Can Be Done Within University Classes And Educational Institutions Or Outside, In Addition To The Possibility Of Achieving The Principle Of Participation And Interaction And Cooperation Between Students With Each Other.

4. Communication: Mobile Devices Provide The Learner With The Possibility Of Using A Number Of Communication And Communication Technologies Such As Wi-Fi, Bluetooth, SMS And Phone Calls. This Helps The Student And Learner To Create Special Learning Groups Through Which The Student Can Communicate With His Friends Realistic And Presumptively, And Exchange With Them Data, Information And Questions And This Helps To Create An Interactive Environment Will Be Under The Supervision Of The Teacher.

5. Adaptability: In The Sense That The Education Is Compatible With The Abilities Of The Learner And Needs, And Respect The Wishes Of The Student Or Learner And His Abilities In The Process Of Interaction With The Parties In The Educational Process, Without Being Restricted To Sit In Certain Places Or Adhere To A Specific Time.

6. Integration Of Educational Content: The Mobile Learning Environment Contributes To The Integration
Of Resources For the Process of Education and Integration Between Them, Thus Helping the Learner and the Student to Think in a Non-Linear Way, and Facilitates the Learner to Move Between Applications, Subjects, and Programs Easily.

Mohamed Ally (2009) and Mohamed and Wahid (2011) find that mobile learning has a range of characteristics:

1. Mobile Learning allows students and learners the possibility of teaching and learning everywhere and at all times.

2. Education provides the opportunity for interaction and easy sharing of educational components.

3. The cost involved in the use of special technologies for education is low and relatively low.

4. External education for learners and students to move easily.

5. Externally accessible access to data and information needed by a teacher or student.

6. Mobile Learning contributes to the provision of an innovative and innovative model of the educational process.

3. Mobile Learning Styles:

According to Aldhashnoyonis (2009: 14), mobile learning patterns can be divided into three types:

1. **Full Mobile Learning:** In this type of education, the process of distance learning, where the student is not determined in time or place specific, that is, the student studies the content of the educational self by downloading educational content on his mobile and then he/she studies it anywhere and fits it.

2. **Partial Mobile Learning:** In this type of education, mobile learning is an adjunct to traditional classroom education. Some mobile learning tools are used in part to support and support traditional classroom education.

3. **Mixed Mobile Learning:** In this type of education, there is a combination of (classroom education and mobile learning). Many specialists consider this style to be very appropriate, as this pattern increases the effectiveness of education, by creating harmony and harmony between requirements of the learner and between the educational content presented. This is one of the best patterns used because it combines the advantages of classroom learning with the benefits of mobile learning.

According to the researcher's view, using mixed mobile learning will benefit students and learners because it combines the use of education traditional classroom and mobile learning.

Lal (2011) adds that the mobile learning follows two patterns in the education process:

1. Mobile learning which is based on electronic means and information without the use of the web: which include (such as interactive multimedia computer programs and e-books).

By using this mode, the learner can browse and watch educational programs, applications, and audio and visual media, store them on mobile phones or store them on computers, e-book reader, and other assistive devices such as PDAS devices.

2. Mobile learning which is based on the use of the web (education through the use of e-learning sites based on the use of the Internet).

By using this mode, the learner can directly connect to websites on the internet where wireless internet technologies are used that allow the learner to communicate instantly with all websites and to enjoy all the advantages of connecting to the internet, so that the learner is able to navigate and interact audio and video as well as through the use of texts with all students or learners or teachers connected to the internet at the same time through the use of mobile phone in a style can be described as interactive tutorial.

3. Services and Benefits of Mobile Education for the Parties in the Educational Process:

Jung Tsung Yang, et al. (2007) and Al-Dahshan (2010), Al-Samdouni (2015) believe that the mobile learning has services and benefits that make it suitable for universities and students of the future.

1. Mobile devices and mobile devices contribute to the dissemination of lectures and discussions directly to students and learners wherever they are. This is achieved by connecting mobile devices to the internet. Students and learners can also use mobile learning to interact and collaborate with each other and teachers.

2. Mobile devices allow the teachers to review students' assignments and tasks. Students can also see their teachers' evaluation results, as well as the ability to take notes easily through SMS.

3. Mobile devices contribute to the direct communication between the parties of the educational process, which includes (the educational institution, the student, and parents, where the parents of the students to follow the results of their children and their academic level and absence on a regular basis, and enable these devices parties to the educational process to participate in the operations and meals in a participatory manner collective.)
4. For Mobile Devices, Including The Mobile Device Is Working To Achieve The Element Of Innovation And Development In Traditional Teaching Methods, Especially In Traditional Educational Institutions, Which Did Not Spend Enough In The Development And Renewal Of Technology And Equipment Of Their Own, As Many Studies Indicate That Mobile Technologies Help To Create New Opportunities Traditional Education, As Well As Creating A Lifelong Learning Style That Is Out Of The Classroom.

5. The Technology Helps Researchers And Students To Create Their Own Libraries, Including Textbooks, Tutorials, And Educational Video Clips.

6. Special Education Technologies Help Learners And Students With Special Needs.

7. Mobile Devices Help Undergraduate Students, Especially Students Who Live Far Away From The Universities They Belong To, Or Students Who Are Not Regularly Associated With Receiving Instructions And Administrative Orders Such As Changing A Test Or A Lecture Or Changing The Delivery Date Of Research Projects. The SMS Service Can Be Used To Obtain All Of This Information Is Faster And Easier.

5 - Devices And Applications That Are Employed In Mobile Learning:

Al Fayez (2009) And Salem (2009) Note That There Are A Number Of Devices And Applications That Can Be Employed In Mobile Learning:

- **Hardware:**

  1. **Notebook Computers:** These Devices Have More Than One Advantage These Features That They Can Replace The Personal Computers In Terms Of Performance, The Second Feature That It Is Portable And Has The Capabilities Of Wireless Communication, And The Most Important Problems That These Devices Suffer Always Be High.

  2. **Computers Tablet Pcs:** These Devices Are The Latest Mobile Devices That Have Specifications That Are Close To Personal Computers, And Some Of Them Do Not Contain A Keyboard Of Their Own, And The Development Is Replaced By Systems Known As Writing, And Are Characterized By A Somewhat High Prices.

  3. **Personal Digital Assistants:** These Devices Are Small In Size And Perform Multiple Functions By Relying On Specific Operating Systems With Features And Specifications That Are Similar To Desktop Operating Systems Such As Microsoft Pocket Pc, Palm OS.

  4. **Mobile Phones (Mobile Phones):** They Are Simple Price Devices And Their Potential Is Weak And Yet Have The Ability To Make Voice Callers As Well As Send SMS.

- **Smart Phones:** Smart Phones With The Ability To Provide Traditional Communication Services As Well As Their Ability To Provide Important Services Such As Internet Browsing And Support For Various Programs Of Their Own, Making Them A Significant Role In Mobile Learning.

- **Applications:**

  1. **Communication with the General Pack of Radio (GPRS):**

     It is an innovative technology that allows mobile devices to enter the Internet at a very high speed and allows the process of data reception and storage and the process of retrieval and exchange wirelessly, and at a low cost, which is calculated by the size of data, most modern handsets are equipped with the latest technology. The user can access the Internet anytime he chooses from anywhere to do the browsing, read the e-mail, and send and receive multimedia messages.

  2. **Mobile Conferencing Service (MCS):**

     This Service Enables The Teacher Or Teacher To Hold A Conference On Mobile Devices. Through This Conference, You Can Talk To A Group Of People At The Same Time, And Through This Package Can Terminate The Conversation With A Person Or To Put A Waiting Feature, The Conference With All Individuals Is Currently Conducting Several Experiments In Order To Activate And Generalize This Experience On The Level Of Mobile Networks.

  3. **Mobile Author:**

     It Is A Modern Application That Allows Teachers And Teachers To Create An Intelligent Learning System For Learners In Any Field. This Application Can Be Accessed Through The Use Of Computers Or Through The Use Of Any Modern Mobile Devices. This System Can Evaluate And Record And Provide The Teacher With Performance Reports Learners, And Can Adapt To The Needs Of Learners And Provide Them With Advice On Their Learning Process.

  4. **SMS:**

     And Allows The Exchange Of Messages Between Mobile Devices And The Number Of Characters In A Single Message To (160 Letters).

  5. **Bluetooth:**

     a modern wireless communication technology to facilitate the exchange of messages between mobile devices and short-term.

  6. **Multimedia (MMS):**

     This Allows For The Exchange Of Messages Between Mobile Devices, Note That These Messages Include (Drawings, Pictures And Sounds).

  7. **Cameras (CAMs):**

     Compact Cameras That Are Present In Mobile Phones And Pdas.

  8. **WAP:**
A Special International Protocol That Allows People Who Use It To Access The Internet Quickly Through Their Mobile Devices.

9 - Files (mp3):

An Audio File Format Through Which The Process Of Compressing Files Efficiently And It Is Possible To Share These Files Together For Two Easily.

6- Mobile Learning Management Systems:

Mobile Education Management Systems (MMS) Are Virtualized Learning Environments Through A Range Of High-Quality Applications Designed To Provide Students With Wireless Devices Such As Laptops, Handsets And Mobile Phones While Helping To Manage, Record, Track And Track Students. Continuously (Goudan, 2012) Refers To The Most Important Mobile Education Management Systems As Follows:

1. Blackboard Mobile Learning System (2.0):
This System Is One Of The Systems Of Educational Management Processes Of Mobile Learning In Institutions Of Higher Education And The Function Of This System Is To Deliver Education To Students And Then Follow Them, And To Allow Students To Communicate And Interact With Each Other Or With Teaching Staff Through Chat Rooms Or E-Mail Or Virtual Classrooms, This System Also Makes It Easier For Students To Access The Content Of The Course At Any Time And Place. The System Also Provides Specialized Templates That Enable Teachers To Develop The Content Of Their Courses. It Also Makes It Easy For Teachers To Manage This Content In An Effective And Intuitive Manner, This System Allows The Teaching Duties And Put Ads In Your Site System On The Web, And Is Blackboard Education System Mobile Of The Most Important Mobile User Education Management Systems Heavily In Higher Education Institutions In Most Countries Of The World.

2. Desire 2 Learn Mobile:
A System That Includes A Number Of Applications For Mobile Education. This System Can Be Easily Used By Higher Education Institutions. It Allows Students To Quickly Access Educational Programs At Anytime And Anywhere In The World. The System Makes It Easy For Students To Collaborate, Communicate And Transfer Information Easily, And It Is Possible To Download This System On Mobile Devices With Ease, Such As Blackberry And Other Mobile Devices.

3. Model Mobile Learning System:
This System Has Unique Characteristics. It Is An Open Source System And Enjoys A Variety Of Characteristics. It Is Subject To Modification And Development By Experienced Users And Spread Throughout Most Of The World. This Advantage Has Led A Large Number Of Higher Education Institutions To Use This System And Thus To Make Use Of It. The Nature Of The Study In This Institution, Where The Educational Institutions Load This To The System Of The Site Of The Company MODEL On The Internet

Second: Previous Studies:

A number of studies have been conducted on the effectiveness of the use of mobile education technology in education:

1. Al Magamdi Study (2011): The Use Of Mobile Learning In The Development Of Scientific Skills And Academic Achievement Among Students Of The University Of Baha.

The Problem Of This Study Is To Identify The Impact Of The Use Of Mobile Learning Through The Use Of SMS And Sending Educational Materials To Increase The Academic Achievement Of The Students Of The Faculty Of Education At Al-Baha University In The Design Decision Of Educational Software. 30 Students Were Divided Into An Experimental Group Consisting Of 15 Students And A Control Group Of 15 Students. The Control Group Was Taught Using The Traditional Method. The Experimental Group Was Taught Through The Use Of Mobile Education. The Results Of The Study Revealed Statistically Significant Differences At (0.05) Between The Mean Of The Experimental Group And The Control Group In Favor Of The Experimental Group In The Final Achievement Test.

3. AL-Khzeem Study (2012): Effectiveness Of The Use Of (Blackboard Mobile) For Mobile Education In The Development Of Interaction And Achievement Of Students In The Curriculum Of Teaching Mathematics In The Teachers College, King Saud University.

The Study Used The Semi-Experimental Method To Measure The Effect Of The Independent Variable (Mobile Education) On The Dependent Variables, Which Include Interaction And Educational Achievement. The Study Also Used The Descriptive Method To Prepare The Theoretical Framework For The Study. The Study May Be From (23) The Study Included A Single Experimental Group For The Difficulty Of Selecting Two Groups. The Sample Included All The Students Of The Mathematics Department In The Teachers College. The Study Tools Included The Measure Of Student Interaction, Achievement Test, The Study Found That There Were Statistically Significant Differences At The Level Of (0.01) Between The Tribal And Remote Measurement In Favor Of The Telemetry.

The Aim Of This Study Was To Identify The Uses Of Mobile Devices As A Tool To Support Learning Programming Languages Through The Use Of SMS. The Study Sample Consisted Of (40) Students In The Field Of Educational And Computer Technologies At The University Of Yildiz, The Sample Was Divided Into Two Experimental Groups Consisting Of (20) Students And A Staff Consisting Of (20) Students. The Researcher Used An Achievement Test That Was Applied Before And After. The Results Of The Study Showed That There Were Differences In Statistical Achievement Between The Experimental And Control Groups For The Experimental Group. Study To Be Used SMS Service Has Greatly Improved Student Learning.

4. **Kiger Et Al., 2012: The Impact Of The Use Of Mobile Education On The Achievement Of Third Grade Students:**

This Study Aimed To Identify The Effectiveness Of Mobile Education In Increasing The Achievement Of Students In The Third Grade In Mathematics. The Study Sample Consisted Of (87) Students From The School Of Medicine In The United States Of America. The Study Used The Experimental Method. (41) Students And Learn Through The Use Of The Device (IPAD), The Study Signal To The Existence Of Differences Of Statistical Significance Of The Level (0.01) Between The Average Score Of The Control Group And Average Scores Of The Total Experimental Test In Favor Of The Experimental Group.

**Third Topic: Research Procedures**

1. **Experimental Design For The Research:**

The design of the two groups (experimental and control) with the post-achievement test was chosen as an experimental design that the researcher deems appropriate to achieve the current research objectives.

2. **Research Community:**

All Students Of The First Year In The Department Of Pathological Analysis At The Faculty Of Applied Sciences At The University Of Samarra For The Academic Year (2016-2017) Were Identified As (180) Students To Be The Research Community.

3. **Research Sample:**

The research sample was randomly selected from the research community. The sample of the research was 36 students representing about 20% of the research community. They were divided into two equal groups and the number of variables affecting the safety of experimental design of the experimental and control groups.

4. **Search Materials:**


- **Determination Of Teaching Objectives:** The Researcher Formulated The Objectives Related To Teaching In The Light Of The General Objectives Of Teaching The Course Of The Fundamentals Of The Computer By The Group In Charge Of Teaching The Course Of Computer Basics In The Faculty Of Applied Sciences And Was Formulated In Terms Of Specific Teaching Objectives Can Be Measured And Has Been Presented To A Group Of Experts And Specialists From In Order To Determine Their Validity And Thus Have Been Definitively Determined To Be The Intended Objectives Of Teaching The Fundamentals Of Computer Curriculum.

- **Preparation Of Teaching Plans:** The Researcher Prepared Four Teaching Plans Using The Usual Method To Be Taught To The Students Of The Two Groups (Experimental And Control) Using The Lecture Method. These Plans Were Presented To A Group Of Experts And Specialists. The Amendments Were Made In Light Of The Opinions And Observations Made By The Group Of Experts And Specialists.

5. **Installing The Viber Program:**

The Researcher Installed The Viper Program On The Mobile Phones For The Group And The Training Program, As Well As His Own, So That He Can Continue With The Request Of The Experimental Group.

6 - **Numbers Of The Final Achievement Test:**

The Researcher Used A Final Achievement Test Consisting Of (40) Questions, 20 Of Which Were Multiple Choice Types, And 20 Questions Of The Type Of Correctness And Mistakes For The Purpose Of Measuring The Information Gained By The Students. The Test Was Presented In Its Preliminary Form To A Number Of Experts And Specialists, (Cooper, 1974: 27). In Order To Conduct The Statistical Analysis Of This Test, It Was Applied To A Survey Sample Consisting Of (18) Students Who Were Selected Without A Sample Research The Discrimination Coefficient, The Coefficient Of Difficulty And The Effectiveness Of The Wrong Substitutes Were Extracted The Test Was Done Through The Use Of The Appropriate Statistical Means, Which Showed That The Test Paragraphs Are Distinctive And Their Coefficient Of Difficulty Is Appropriate, And That The Effectiveness Of The Wrong Alternatives Is Good. Based On This, The Test Is Considered Honest To Apply To The Selected Research Sample.

7. **Application Of The Achievement Test:**

The Researcher Conducted The Teaching Process Using The Usual Method (The Lecture) For The Students Of The Two Groups (Experimental And Control) At The Same Time In Order
To Minimize The Effect Of The Variables On The Search Results. The Teaching Process Continued For Four Weeks By Two Theoretical Hours Each Week, Where The Control Group The Usual Method Is Used Only. The Experimental Group Used The Usual Method In Addition To Using The Viber Program On Their Mobile Devices. The Communication Process Took Place Between Them And The Teacher Outside The Lecture Time. And A Video Clip On Video And Audio, And Powerpoint Presentations On The Material They Are Studying In The Lecture, Which Includes The Four Subjects Identified From The Basic Course. After The Completion Of The Teaching Process, Which Lasted Four Weeks, The Final Test Was Applied To The Students Of The Groups (Experimental And Control). At The Same Time, The Test Was Re-Applied To The Students Of The Two Groups Three Weeks After The First Application So That The Test To Retain The Information Without Giving Any Information To The Students About The Test Date And Without Providing Any Information About The Course Material During The Period Between The Two Tests, Have Been Using A Number Of Appropriate Statistical Methods For Analyzing The Results Of These Tests.

8. Statistical Methods: The Researcher Used A Number Of Statistical Methods, Including:

- Analysis Of Mono-Variance.
- Pearson Correlation Coefficient.
- And The Equivalent Of Karon Bach-Alpha.

In Order To Achieve Equivalence As Well As Extract The Validity And Stability Of The Final Collection Test, And Then Analyze The Results Of Research And Knowledge Of Statistical Differences Between The Experimental And Control Groups.

9- Research Results:

1. There Are Statistically Significant Differences At The Level Of Significance (0.05) Between The Mean Of The Experimental Group And The Average Of The Students Of The Control Group In The Final Achievement Test For The Benefit Of The Experimental Group.

2. There Is A Statistically Significant Difference Between (0.05) Between The Mean Scores Of The Experimental Group And The Average Of The Students In The Control Group In The Information Retention Test For The Experimental Group.

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10- Discuss Search Results:

By Observing The Results Of The Research Shown In Table (1), We Observe The Superiority Of The Arithmetic Mean Of The Experimental Group In The Test Of The Academic Achievement And The Test Of The Retention Of Information On The Arithmetic Average Of The Control Group. Therefore, The Students Of The Experimental Group Obtained A Set Of Advantages Use Mobile Phone Technology Represented By

- The Viber Program, In Order For The Students Of The Experimental Group To Communicate With The Teacher Outside The Lecture Time And Then Receive Explanatory And Enhanced Information Relating To The Material Studied During The Lecture. This Information Becomes A Helpful And Facilitator For The Understanding Of The Subject. The Results Were Better Than Those Of The Control Group In The Final Test. The Same Was True With Regard To The Information Retention Test Applied By The Researcher After A Period Of Application Of The Final Test Without The Students Having Any Knowledge Of The Exam Date, The Students Of The Experimental Group Were Able To Maintain The Information For A Longer Period Of Control Group Students. This Was Demonstrated By The Test Of The Retention Of Information. The Experimental Group Students Obtained Better Results Than The Students In The Control Group In The Retention Test. This Indicates The Importance Of Using Mobile Education Technology In The Teaching Of Courses In General And The Course Of Computer Basics In Particular, Because It Is Of Great Importance In Attracting The Attention Of Students And
Increase Their Motivation Towards Learning And Help Them To Keep The Information Longer

**Table (1) Results Of The Research**

**11- Recommendations:**

1- The Necessity Of Working On The Awareness Of The Parties Involved In The Educational Process And The Parents Of The Students Regarding The Role That The Special Education Technology Can Play In The Education Process, And Its Great Impact On The Increase In Academic Achievement In The Computer Section.

2 - The Effective Use Of Mobile Devices, Especially With The Increasing Number Of Users As Well As In The Diversity Of Services Provided Through These Devices.

3- Pay Attention To Mobile Education Technology As One Of The Technological Innovations In The Field Of Education, Which Helps To Face Individual Differences Among Learners, And Thus Contribute To Raising The Level Of Educational Achievement For Them.

4- Emphasize That The Curricula In The Universities Include Activities And Training To Ensure Communication Between Students And Their Teachers Through The Use Of Mobile Technology.

5 - Work On The Training Of University Teachers On The Skills Of Mobile Education Technology Because Of Their Significant Role In The Improvement And Development Of The Educational Process.

6. To Provide Financial Support For Mobile Education Technology In University And Educational Institutions.

7 - Conduct More Research And Studies On Activating The Use Of Mobile Education Technology In The Educational Process In Universities, And How To Deal With This Technology From The Development Of Educational Material, And Dissemination To Students And Learners, And How To Send Meals And Receive And Correct And Then Put Feedback.

**12-Conclusions**

1 - The Use Of Mobile Education Technology Represented By The Use Of The Program (Viber) As An Assistant In The Process Of Teaching The Course Of Computer Fundamentals Has Had A Significant Positive Impact On The Growth And Development Of Students' Academic Achievement.

2 - The Use Of Mobile Education Technology Represented By The Use Of The Program (Viber) As An Assistant In The Process Of Teaching The Course Of Computer Fundamentals Has Had A Significant Positive Impact In The Retention Of Information For Students For A Longer Period.

3. The Use Of Mobile Learning Technology By Using The Viber Program As An A djunct To The Teaching Process For Additional Explanatory Information On The Subject Taught By The Teacher In The Traditional Lecture Is A New And Innovative Way To Improve The Learning Process.

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Diagnostic, Therapeutic Monitoring of Tuberculosis Patients of Silk City by Telemedicine

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Abstract- In this era of Mobile world, the no of mobiles in a family outnumber the members living in the same household!!!!!!It simply explains the importance of this hand set & its inevitable role in an individual’s routine.

It can be used not only for personal & official communication but also for MEDICAL PURPOSE!

Context: To bring telemedicine in diagnostic & therapeutic management of TB patients in rural area.

Aims: To study diagnostic, therapeutic monitoring of Tuberculosis in our patients attending our pulmonology department.

Settings and Design: Study was planned for three months-Oct to Dec 2015.

It was done in three different phases: I, II, III

Methods and Material: Clinically suspected cases were included

Phase I:

The faculties & patients were informed separately about this Telemedicine project by sensitization program.(-pic1 &2.)

Phase II:

The selected, willing patients were divided into two categories as follows:
(a) Those who had mobile phones with talking facility only
(b) Others with mobile phones that also had video & Skype facilities.

Phase III:

Collection & analysis of the video chats - for the completion of the project.

Statistical analysis used: SPSS 20

Results: Of the 75 willing participating patients, 51 were found to be AFB positive, having 68% positivity, which was a high incidence. They were found to be positive both by acid fast stain & culture.

37 patients had mobile with video & Skype APP, included under direct follow up. Among these 37, 32 were highly interactive, communicating with the treating pulmonologist (video-2) at the given time for therapeutic monitoring.

Conclusions: This is an essential process to prevent the occurrence of resistance development in TB causing bacteria (ref2).

Our study ensures this, along with the follow up of the deadly multidrug resistant disease.

Index Terms- Telemedicine, Diagnostic & monitoring

Key Messages: Telemedicine is very effective in the diagnostic and therapeutic management of TB patients by mobiles in rural tertiary care centres.

I. INTRODUCTION

In this era of Mobile world, the no of mobiles in a family outnumber the members living in the same household!!!!! it simply explains the importance of this hand set & it’s inevitable role in an individual’s routine.

It can be used not only for personal & official communication but also for MEDICAL MANAGEMENT!

This equipment can be used as an effective instrument in the diagnostic & therapeutic monitoring of tuberculosis by two way communications between the diseased & the treating physician. so, we planned to undertake a study on the diagnostic, therapeutic monitoring of Tuberculosis in our patients attending our Pulmonology department in our hospital, which is situated in the SILK CITY OF TAMIL NADU! Kanchipuram District.

II. SUBJECTS AND METHODS

Inclusion criteria: Out patients with: cough with expectoration > 2 weeks duration, Hemoptysis+/-, evening rise of temperature, loss of weight, F/H of tuberculosis, contact with TB & willing patient

Exclusion criteria: unwilling patients , Inpatients ,other LRT cases

No of patients enrolled: 75.

Study was planned for three months-Oct to Dec 2015.

It was done in three different phases: I, II, III

Phase I: Sensitisation of the Faculties & patients

Phase II: Actual video chat & Skype discussion - a) House visit

b) Direct follow up

Phase III: Data collection –video chat & analysis.

Phase I:

The faculties & patients were informed separately about this Telemedicine project by sensitization program.(-pic1 &2.)

The Department of Pulmonology /TBCD had 434 patients in the three months period of October, November & December 2015. Of this 434, there were 288 males & 146 females, giving a ratio of 3:1.

From this group, 75 willing patients, whose consent was taken in regional language, (attachment -1) were enrolled for the study. These 75 patients were screened by Acid fast stain, culture in Middle Brooke’s method.

**Phase II:**

The selected patients had to be divided into two categories as

(a) Patients with Mobile phones that had talking facility only,
(b) others with mobile phones with video & Skype facilities also

The first group required support, for the video chatting, as they were willing to participate in the project; these patients were included under the HOUSE VISIT GROUP.

The second group who had phone with video & Skype facility were included under the DIRECT FOLLOW UP GROUP.

**Phase III:**

The video chat was collected & it was analyzed for the completion of the project.

The project was started with the sensitization programme for the junior faculties & CRRI in the beginning of October.

After which a separate program for the patients awareness was done.

The written consent from 75 willing patients in regional language was obtained.

The Direct follow up group – those with video & Skype facility were registered separately, were given unique log in Id, for the direct observational monitoring of drug intake & diagnostic updating.

The other group, possessing only mobile phones, without any added APPS, who were willing to par take in the group, were monitored with the help of the Junior Residents (JR) or House Surgeons (CRRI)-by House visit method.

The chat & drug intake was video tapped & was maintained as the recorded document for therapeutic monitoring – (video-1)

The diagnostic monitoring for the patients was made feasible, by selecting six labs, whose staining & reporting corroborated with our reporting technique with the same clinical specimen. Patients were encouraged to have their specimens investigated in these selected nearest lab. They were guided to upload the report as image (images 1&2)

These images were also saved & maintained as recorded document for diagnostic prognosis.

At the end of the third month, after screening the willing positive participants, the chats were collected, analyzed & report was prepared.

**III. RESULTS**

‘Of the 75 willing participating patients, 51 were found to be positive, having 68% positivity, which is a high incidence. They were found to be positive both by acid fast stain & culture. 37 patients had mobile with video & Skype APP, had direct follow up. Among these 37, 32 were highly interactive, communicating with the treating pulmonologist (video-2) at the given time for therapeutic monitoring.

5 patients were refraining from active chatting & had to be encouraged frequently, in that 2 were non cooperative due to personal reasons.

14 patients had only mobile without any required APP, supported by the Skype & video chat of the electronic gadget of the JR & CRRI.

**IV. DISCUSSION**

Telemedicine is an ideal method for monitoring the therapeutic & diagnostic technique of managing TB patients, who are living in rural areas where, transport facilities are very poor.

This project was launched by the joint venture of Departments of Microbiology & Pulmonology (TBCD).

This workup had its positive response in the form of quick turnaround time (TAT), less time consumed for meeting the treating physicians, from their own home/work place, without affecting their routine. It was more an individual based meeting, therefore had more positive impact, rather than waiting in the hospital clinic, for their turn to come!!!

For the house visit program, our project was unique in that, the medical officers –JR/CRRI went with their mobiles with the necessary APPS & made the video chat feasible & ensured the monitoring of drug intake (video 3)

As per norm, the success of TB control program relies on the proper intake of the ATT & its monitoring (ref 1).

This is an essential process to prevent the occurrence of resistance development in TB causing bacteria (ref2).

Our study ensures this, along with the follow up assessment of diagnostic indicator.

The patients who were monitored by these two methods felt happy to have their physician contact in a comfortable & convenient ambience, supported by the JR /CRRI wherever required, especially in rural area where the patients are residing in far flung areas with less transport facilities.

This networking not only builds an effective relationship between the treated & treating but also ensures proper monitoring of intake of the ATT.

**V. CONCLUSION**

Our study is an effective monitoring technique of therapeutic & diagnostic indicators of Tuberculosis management.

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Filipino Fathers as Primary Caregivers

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Abstract: This study was about the experiences of 16 Filipino fathers who served as the primary care takers of their children while their wives were working outside the Philippines. They hailed from the city of General Santos and Koronadal and others were from the provinces of Sarangani, South Cotabato and Cotabato.

Through a one-on-one in-depth and taped interview and conversation, narratives of fathers were captured. Guided by a grand tour question related to the experiences of the fathers as they hurdled the daily activities with the children, the participants openly shared their involvement on the children’s activities of daily living, their manner of disciplining the kids, the strategies in promoting health and on their actions whenever the children get sick. In addition, the fathers echoed their feelings while taking care of the children and shared their involvement in child’s care when their wives were still around and the time when they were left alone to cope with the responsibilities at home.

Using Gibson and Connor’s five (5) steps in analyzing data result, the study came up with six (6) themes which included (1) total involvement on the children and household concerns as a manifestation of child care, (2) evolving disciplinary techniques on children to make them obey orders, (3) ensuring children are free from sickness and medicating them when sick. Other themes are (4) mixed feelings for childcare (5) caring for the sick child as the most challenging responsibility (6) considers wife is the best in childcare.

Having identified and discussed the themes, recommendations were made particularly on the inclusion of fathers in health programs not as clients but as agents of change on health related matters.

Keywords: Filipino fathers, househusbands, primary caregivers, transnational

INTRODUCTION

This qualitative case study is a picture of how Filipino fathers assumed the responsibility of their wives who went abroad to earn for the family. In a traditional Filipino household, the role of fathers in the family was primarily to serve as breadwinners while the mothers were responsible for doing the household chores and in taking care of the children (Bustos and Espiritu, 1996, Rabaino, 2014, Kamaruddin et al. 2013). However, with the advent of globalization and job opportunities for women abroad, the structure of families has changed Bond (2010). The migration of women abroad, according to Pabico (2005), made changes in the role of husbands and wives, which for Dias (20016) does not always give good results to their respective families. Parrenas (2005) said Filipino fathers avoid nurturing and parenting responsibilities while their wives were away, an observation seconded by Rabaino (2014) who mentioned if the mother worked overseas, the fathers failed to assume the role of the caretaker leaving the children without the necessary care they need.
Despite the negative reports on fathers regarding child rearing, fathers made significant contributions to the child's general well-being (Kotelchuck and Moore, 2004). In Higham and Davies (2012), fathers as primary caregivers were responsible for assisting their children in the activities of daily living like grooming; doing medical decisions and helping the children develop their coping skills. Also, in Richter and Morell (2006), men whose wives were employed often attended health centers for child's immunization, brought children to and from school and gave health care at home.

Regardless of this report, relatively to date only a few studies were made in reference to the involvement of fathers in child's health care (Kotelchuck and Moore, 2004, Kramer and McCulloch, 2013) and studies conducted related to fathers continued to be on limited samples (Lamb, 2014). This was because for Thompson and Kramer (2002), O'Brien (2003) and Davies (2013), most of the researchers were focused on female caregivers thereby disregarding the experiences of caregiving men and marginalizing the contributions that they have made for the family especially on child’s health needs. It is for this reason that the researcher embarked on the study about Filipino fathers as primary care givers particularly in the areas of disease prevention, and management of common illnesses.

METHODS

The study was conducted in Region 12 of South Central Mindanao. In 2009, Region 12 has the most number of Overseas Filipino Workers (OFWs) from Mindanao with more than 4.2% of the country’s 1, 920,000 registered migrant workers. Region 12 with 21,256 OFW’s has surpassed Region XI or Davao region, the most prolific exporters of Filipino in Mindanao (Espijo, 2011).

Using nonprobability purposive sampling method, particularly purposive – convenience sampling which according to Merriam (2009) is the best for qualitative research, 16 fathers served as the participants of this undertaking. The fathers who have biological child/children of seven (7) years old and below do not have other members of the family at home except for their children.

This research used qualitative case study design. Case study research according to Baskarada (2013) involves intensive analysis of an individual unit like person, family or community while for Neale et al. (2006), is a story about individuals, processes, and even events that is unique, special, or interesting. If, for Neale (2006) case study explores the complete picture of the phenomenon, Merriam (2009) anchored case studies to real life situations. In this research work, the experiences of fathers being primary caregivers of their children were unearthed. It also includes care practices of fathers to their children, their feelings in taking care of the kids, their promotion, prevention and management of child’s illnesses. Moreover, their involvement in the meal, play, studies of the children and how are they as fathers when their wives were still around and now that they are in charge of everything were also part of the father’s narratives. Since only few studies were made about the contributions of fathers in child care (Higham and Davies, 2012) and their contributions to health care were unexplored (Kramer and Thompson, 2002), this study made an in depth understanding of the complex factors that contributed to the caring behavior of fathers. This design employed interview of fathers in natural setting ensuring that it followed ethical standards for research.

O’ Cannor and Gibson, (n.d.) data analysis was employed in this study. This includes organizing the data, finding and organizing ideas and concepts, building over – arching themes in the data, ensuring reliability and validity in the data analysis and finding possible and plausible explanation of the study.

RESULTS

Fathers claimed they did everything for their children. This responsibility started the moment they woke up until they retired at night. These responsibilities covered not only the concern on their children’s activities of daily living like grooming, feeding, schooling and a lot more, but also the household tasks that were traditionally done by women in the Filipino culture. To be able to do these everyday jobs, most of them wake up as early as three o’clock or four o’clock in the morning. With no one to rely on, these fathers who took care of one (1) to seven (7) children, having had preschoolers or graders called themselves multitaskers while others claimed to be “inatay”, a colloquial term for tatay at nanay or father and mother. By being multitaskers, the fathers here described themselves as the mothers and at the same time the fathers of their kids since they were alone in doing childcare and household chores.

The caring behavior of the fathers resonated too on their deep involvement in the hygiene, meals, and studies of the children. In terms of hygiene, the fathers looked into the detailed cleanliness of their kids' as most of them made sure that children were able to bath every day, particularly before going to school. Comes mealtime, may that be breakfast, lunch or dinner; the participants ensured that their offspring have eaten their food. Almost all of the fathers said they have easily prepared food on the table like canned goods, noodles or eggs for breakfast.
Concerning the study of the kids, fathers like Mago, Obet, Mello, Champ, and Lino shared that every night, they tutored their children on their assignments while Iko, Arn, Jomar and Mello only checked if kids have assignments and reminded them to do it. On the other hand, Dencio and Justo no longer tutored their kids because they believed their children are excelling in class. For the rest of the fathers, tutoring was delegated to older siblings. The participants were not only involved in their children's homework but also in the school activities as well, because the majority of them joined school organized gathering of parents and were even voted as officers in parents – teacher’s organizations.

Related to health promotion, fathers kept their children healthy thru good personal hygiene. This hygiene included cleaning of fingernails, brushing teeth, bathing every day and washing before sleeping at night, washing hands before meals, and wearing of clean clothing. There were also fathers who believed that exposure to too much heat and cold, especially on drizzles or drafts, caused illness. Another way of promoting health was through children’s safety. Ven, Iko, Jomar, Alz, Champ, Lino and Mello shared about how they carried this out to their kids. A number of them said when at home or in school, children were often reminded about safe crossing on streets. The participants also fetched their children for lunch to avoid falls because of playing while on lunch break. Other fathers also kept the sharp objects at home, did not allow cooking to avoid burns, and prohibited their children to be out of the house when they were not around.

In terms of discipline, the fathers used various techniques in controlling their children. Majority of them usually talk or gave advice to their offspring, and often shared about appropriate behaviors. These were exemplified in the narratives of Iko, Arn, Mago, Rodel, Jomar, Mello, Justo and Miko. Another way of addressing parental concerns was through punishment like spanking, pinching and often shouting at children. These methods according to some were only to scare the children and made them understand that their behaviors were no longer acceptable. Most of the fathers claimed they never go into harsh physical punishment because of the fear that children will get sick after the action which in turn will bring another problem, and because of pity to the children considering that they were still small and their mothers were not around thus they have no one to run to. Another reason was that they do not want to hear negative comments from their partners on how they took care of the kids while they were not around. Others use a combination of both, giving advices and physical punishments.

During sickness, unexpectedly, most of the fathers, like Ven, Iko, Mago, Mello, Justo, Champ Aldo, Miko and Lino medicated their children. The basis for this was the previous prescriptions of the doctors, the medicines given by wives before, the one suggested in the pharmacy, and the experience they had based on earlier encounters. If few of the participants referred to their wives on what to do to the sick child, Arn, Rodel, Obet, Mello, and Ahmad used to bring their kids to a medical facility either the following day after a night of fever or when after the medication the manifestations were still present.

In the sense that fathers claimed to have encountered difficulties, more so, that some can no longer hang out with friends, the two major situations they described as the hardest part of child rearing are when the children were sick and when they themselves were sick. Primarily, when children were sick, the fathers did not know what to do. Being sleepless at night while taking care of the sick child, once hospitalized fathers were more puzzled as to who will take care of the other children who were left at home plus the enormous hospital expenses. Often, relatives were the persons whom they can immediately ask for help. In cases when fathers are sick, despite the condition, they mentioned they have no choice but do the household chores not even minding their ailment. This situation made them lonely and stressed.

Despite the above challenges, the fathers claimed that their dual role at home was not at all difficulties but also brought them joy and contentment for they claimed that they were able to raise their children well in spite of being alone. Even with this realization, majority of them mentioned that still their partners are the best in child rearing since the mothers can easily pacify a crying child, detect sicknesses and easily manages it.

DISCUSSIONS

Total Involvement on the children and household concerns as a manifestation of childcare

The storylines of the fathers related to how they hurdled the day-to-day activities of the family even in the absence of their wives manifested the husbands' total involvement in childcare. Halle (2003) identified three (3) main ways, which will show father's involvement with their children. These were father's direct contact with the child, their availability to the children and their responsibility for their children's care and welfare. The involvement of the fathers in this study is a manifestation of a total concern for their children’s well-being as they fully spend with their children their time in doing the household chores like cooking, washing and ironing of clothes, cleaning and performing the routine physical care activities for their preschool and school aged kids. These acts of the fathers were also described in the study of Taylor (2008) who is the same with the fathers here also did the laundry, cooked, budgeted for groceries and prepared kids for school.

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In terms of cooking, although fathers here prepared simple viands, they usually ensured that children have complete meal every day. For most of the fathers, it was important that kids have something to eat than to consider the nutritional value of the foods that were taken. This was because almost all of the fathers often dwell on easy to prepare foods and easily accessed foods like eggs, hotdog, noodles, canned goods, and fish soup, which is abundant in the Philippines and the immediate food fathers can prepare on the table (Torres, 2002). The readily available foods were the ones being bought from the neighborhood is commonly called in the Philippines as “turo-turo” (point – point or choose) from which a number of different preparations were offered for the customers to just point on their choices (Torres, 2002). The accounts of the participants related to the simplicity of the food they served at the table were not surprising because of the scanty literature (Khandpur, 2014) on food preparation of the fathers mentioned that indeed, they seldom cook (Redmas, Promundo and EME 2014, De Vault, 1994). Furthermore, Miller (2010) shared other fathers identified food preparation and planning the children’s meals as an area where they do not have expertise or responsibilities. On the other hand, Dreby (2007) revealed when mothers left, the other members of the family have the responsibility of preparing the foods for the children. Generally, it was believed that the responsibility of preparing food for the family is being delegated to the mothers or wives (Kamaruddin, et al. 2013). Because of this, even with the evolving roles of couples, the majority of the fathers in this study found cooking as a difficult task, resulting in their dependence on already cooked food that can be bought from the neighborhood or the preparation of processed food.

One common value among Filipinos is their high regard for education. This was the reason why parent/s worked abroad in order to sustain the education of the children (Torres, 2002). In this study, despite the low educational levels of fathers where most were on high school levels and few were elementary, part of the day-to-day activities among the majority of them was to ensure that they were able to help their preschoolers and school aged children in their studies. The assistance of fathers was through tutoring at night or helping with the children’s homework and their attendance to the children's school activities. Ortiz et al. (1999) shared that those fathers who were involved in some activities like bathing and feeding of children, in which participants of this study were very much involved, were likely to read more to their younger kids (Saracho, 2007) in Pattnaik (2013). Another interesting result of this study presented that fathers were active on their child’s school activities. This was because many of the fathers became officers of the classroom PTA or even the whole school and even volunteered in schools’ activities. Gadsden and Ray (2003) supported this finding. According to them, fathers assumed the role of the mother in a single headed family, thus, fathers’ school activity included attending a general school meeting; attending a regular schedule; parents – teacher’s conference with the child’s teacher, attending a school or class event; and volunteering at the school. Moreover, Inham et al. (2015) shared that today, fatherly care assumed many forms for assisting homework and attending parents – teacher’s conference. These activities of the fathers were manifestations of what Ricci and Kyle (2009) shared that parents must collaborate with teachers and school personnel to be able to ensure that children are fulfilling the expectations and requirements specific for their age groups.

Evolving disciplinary techniques to children to make them obey orders

Disciplining children has often been thought of an adult duty, a power that was given to them by society. This emerged from cultural norms that said they have an absolute control and authority over their children (Sanapo, 2013). Disciplining may also be patterned from how parents were raised before. In Cabrera and Tamis - Lemonda (2013), behavioral patterns of childhood were the results of lessons learned from seeing others and adjusting one’s behavior accordingly. More so, Caspi and Elder (1988 in Capaldi, et al. 2008) cited many of the parenting behaviors of the parents were assumed to be learned from their parents too. Despite the variances in ages and educational background, the participants have commonality in instilling discipline to kids. Regardless too of the religious and ethnic affiliation, all of the fathers imposed the same disciplinary techniques to children for them to obey orders. Interestingly, at the young age of their children, giving advice, talking or sharing of experiences was commonly done by the fathers especially when they were about to sleep. Often, fathers discussed appropriate behavior, the negative influence of bad friends and the disadvantage of quarreling with siblings. Reminding children about the sacrifices of the mothers to be able to send them to school was also being used by fathers to encourage the children to study more. Though there was no available literature about this style of father's disciplining technique, the conversations as mentioned in Working Mother (2007), where the special time spent by fathers in bonding with their children, especially during bedtime.

Another way of addressing parental concerns was through punishment like spanking, pinching and often shouting at children. These methods according the fathers in this study were only to scare the children and made them understand that their behaviors were no longer acceptable. Physical punishment as a disciplinary strategy was universal, and previous studies said physical punishment pointed out as the majority of the child rearing practices in the Philippines, (Sanapo, 2003). In a study conducted among 80 mothers from Ilo – Ilo, Philippines it showed that 80% punished their children physically (71% pinching and 65% spanking). This, according to them was done to mold the children to be better citizens in the future. They also quoted a bible verse which said, “Sparing the rod, spoiling the child”, which also served as their basis in doing the act since for them God allowed the child to be beaten in order to teach them a lesson (Sanapo, 2003).

Ensuring children are free from sickness and medicating when sick
Though Filipinos value hygiene by maintaining bathing practices to avoid illnesses (Goody and Drago, 2010), only a few of the fathers in this study cited hygiene as their way of limiting children’s exposure to ailments. In a report of Barthelemy (2009), men were featured as less likely to wash hands properly. More so, it was mentioned they often need blunt reminders to lather up their hands. Hand hygiene is the most important way of avoiding contact with germs (WHO, 2009).

The fathers also believed that when a child was exposed to the rain the later will get sick. This was related to the belief of the Filipinos on "pasma", a roughly defined exposure illness when the condition of hotness was being attacked by the element of cold or vice versa. Tan (2008), as cited by Abad et al. (2004). Because of these, some fathers do not allow the children to be out of the house when there were drizzles or during the hottest time of the day. They also monitored the back of the child’s body for sweat. This practice was based on the Filipino’s view of health and wellness from the perspective of balance between hotness and coldness that said that a quick change from both might trigger colds, fever, respiratory tract infection and rheumatism (Goody and Drago 2010).

Fathers also ensured child safety whether at home or in school. When at home, they do not allow their children to cook because of their fear of burning. They also advised their kids not to play with sharp objects and matches. Much more upon going to/from school, they reminded their children to be extra careful with the vehicles or often they ensured that they themselves brought and fetched the kids to and from school. The issue of road traffic injuries became pandemic worldwide killing around 250,000 children annually and in the Philippines, there were more than 20 million children who walked on streets everyday in going to and from school exposing them to road traffic injuries (International Walk to School, 2014).

Results showed if children were sick, majority of the fathers solely medicated their children. Fathers proudly said they already knew how to identify sickness by just merely touching, observing and looking at the child. Once sickness of children was identified, fathers just bought the perceived needed medicines and immediately gave these to their kids or they self-medicate for fever, cough, colds, asthma and even abdominal pains where antibiotics were commonly used. Fathers in this study relied much on the information of the acquired drugs from the labels on the boxes of bottles. This action can lead to misunderstanding of medicine instructions, especially of the package insert information and that of the rational use of medicines (WHO, 2007). A report by Philippine Center for Investigation (2015) revealed that Filipinos has been practicing self-diagnosis and self-medication due to the government's meagre resources for health. Moreover, another study result showed that majority of childhood illnesses in the Philippines were treated at home, without consulting a doctor. Treatment was based on pharmaceuticals – both prescriptions and none prescription drugs (Hardon, 1987). In addition, Robles (2006) disclosed that common practice among Filipinos is to use medicines without prescription every time patients experience discomforts such as a headache, runny nose, cough, and stomachache. This practice of fathers was synonymous to what was revealed by the World Health Organization (2007), that in many low-income countries, a considerable number on the supply of medicine is by passing the official health care system. The same was true with the study conducted by Geest and Hardon (1990), they said that in many developing countries, prescription drugs were freely available over the counter. They added that drug regulations were limited or not implemented and that health care was not functioning.

Once being medicated and the children’s condition did not improve after a few days of treatment, the immediate action of the fathers was to refer the sick child to a health practitioner. Study findings revealed many of the fathers’ first line of referrals were “manghihilot” (traditional Filipino massager) or “arbolaryos” (Filipino folk healers) (Herrera et al. n.d.). According to de Torres (2002), poverty, coupled with a strong sense of religion acquired from Spanish friars and a kind of alternative form, has developed in the Philippines, that instead of going to the doctors, some people go to these traditional healers.

Results also showed that only a few fathers resorted on referrals to health professionals when the children were sick. Most often, this happened when the condition of the children did not improve after the self - medications. In a health forum of the Philippine College of Physicians, their president, Dr. Anthony Leachon described, when patients come to them to seek medical advice, the patients are very sick already (Mateo, 2014). This practice of the fathers was similar to that of Bennson and Maarkowts (2014) that fathers seldom bring their children to physicians for medical check – up because Peate, (2007) revealed there men seldom report illness.

In Pilliterri (2010), a research was made related to health provider visits of a female single headed family and male single headed family. Results of that study showed that despite the difference in insurance coverage of fathers and mothers, males have a lower likelihood of having a usual source of care. Bennson and Maarkowts (2014) reported that children of single fathers received less health care. This was because at different times of their lives, men viewed medical care were for women. Health for men at an early age has always been a domain that belonged to women. As boys, until they reached 16 years old, they were often brought to clinics by any of their female relatives.

Results of this study also disclosed that the fathers sometimes felt ashamed when bringing the children in the health facilities and the belief that they were in control of the situation during the children’s sickness.

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There were many socio-cultural factors that have the ability to influence health related behavior, and gender was one of them. Accordingly, men seldom submit for health visits because they believed asking advice from medical authorities was not “macho” (Peate, 2007). Though historically, fathers were recognized to have greatly contributed to the well - being of the children, often that role was overlooked (Bond, Cuningham et al., 2010). This might be affected by cultural dynamics and practices (Phakathi, 2009), the difficulty of involving of fathers in the maternal and child health care services (Plasten, 2007) or the gender norm that care was biased for women (Engaging men as Partners, 2011). Further, Plasten (2007) said that for men to seek help from a nurse on a doctor was a sign of weakness; and in Peate (2007), research result showed that men felt primary care was unwelcoming for them and that this was designed for women. Garfield and Isaceo (2006) mentioned sometimes fathers felt they were being viewed by health care staff as having a lower quality of service than the mothers and that they have a less emotional bond with the children than the mothers. Moreover, stay- at-home fathers were routinely confronted with stigma due to their flouting of the social norm surrounding masculine behavior.

**Mixed feelings for child care**

If fathers do not have enough experience in child care before their partners left, they will also have difficulty to childcare and home management when their wives already left Pillitteri (2010). This was true to the shared experiences of the fathers in this study. As solo parents, fathers felt the difficulty when their wives left. These difficulties were referred by them as their struggles in the morning doing the household chores while at the same time preparing the kids for school, the hitches in organizing the overwhelming activities at home, their worries when they have nothing to eat. On top of these all they also recalled the difficult times when their kids were still babies especially in waking up at night time to prepare the milk.

Undeniably, changes in the role of couples do not always bring positive results to men (Dias, 2006). There are fathers who said that although they loved their babies, they also suffered the loss of self - esteem, physical dexterity and intellectual edge. Fathers also often found loneliness a problem (Pruett, 2007), and the switch of duty made them less of a man, while others admitted that their present role was harder than holding down a job (Bond, 2012). Tasks like buying of groceries, mending, ironing, doing dishes, and keeping the house clean were difficult adjustments for them (Bun 2009). On the other hand in Lupton (2012), the stay at home fathers dealt with social stigma and sense of self-worth.

Although their tasks were exhausting, yet according to them they were able to carry out the responsibilities which were left to them by their partners for more than a year already. Fathers developed an intense attachment to their babies and a sense of themselves as primary caregivers in stages. They gained a reciprocal nurturing relationship with their babies at different rates, most often will depend on how fathers get themselves ready for their role in their family (Pruett, 1997). Despite the struggles the fathers encountered, they continued with their duties which were accorded to them by their wives. This was congruent to what was cited by Crane and Hill (2009) that if mothers spent more time away from home, the fathers increased their involvement with their children by monitoring their activities and queries about their day. This might be because fathers’ involvement becomes higher when their partners expected them to be more involved (Maurer et al. 2001 in Pleck and Hofferth, 2011). More so, in cases when mothers were no longer around, the father took over the role of primary caregiver, providing full assistance on the child’s activities of daily living (Thompson and Kramer, 2002). It was further revealed that the absence of woman in the family entailed greater participation of husbands in care work (Baldassar and Merla, 2014). A study of Filipino transnational families disclosed husbands who were left by their partners tend to have more work during the initial migration of their wives because their children were still young and were dependent on adult care (Baldassar and Merla, 2014). True enough, when the children in this study were still young, the participants shared about their sleepless nights preparing the milk, doing some lullaby to bring kids to sleep and even on checking if the child was wet from urine. It was also found out that most of the fathers really found it hard to adjust to their new roles during the initial phase of their wives migration. They were afraid because they did not know if they can handle the responsibilities that were passed on to them. These fears were also associated with the feelings that they were incapable of rearing the children. These emotional state as cited by (Scalabrini, Hearts Apart, 2003) in Cortes (2007) were because men do not easily take up caregiving.

**Being sick and caring for a sick child are the most challenging responsibilities**

On top of all hardships in childcare taking care of the sick children was the most grueling part of the fathers’ responsibilities according to the participants in this study. For fathers, their hardships were doubled when children were sick. The verbalizations of difficulties were mirrored to a claim of a father who said he almost call all the saints especially when children were sick at night and another father felt it was like almost losing his sanity. The illness of the children intensified the father’s emotions that may cause the change of their usual behavior in responding to this kind of concern (Hsu – Lin, 1992).

The experiences of fathers during their child’s sickness did not only trouble their physical body yet, many became irritable, fearful, lonely, and helpless because they have no one to talk to or ask for an advice. These same feelings were also discussed by Palkovitz (2002) who mentioned that fathers were helpless when children were ill. This was because, for Pillitteri (2010), there was no second person who would give reassurance or a second opinion about the child’s condition. Plantin (2007) has the same explanation with Pellitteri and Palkovitz by saying that even if fathers shared some of the responsibilities for the sick child, they still
relayed much on their wives. For the fathers in this study, despite the distance of the wives from their transnational family, still, the husbands referred to their wives what medicines to take or what to do to a particular ailment of the child. There were also instances when fathers no longer tell their wives about the sickness of the children because according to them they did not want their partners to worry. This may be because as Davies and Davies (2011) revealed, at times fathers need to look strong hence they were reluctant to talk while Baldassar and Merla (2009) shared men kept to themselves all serious and heavy problems like sickness among children.

Men seek sympathy during ailment as Alleyne (2010) noted when a male is sick, he has a complete system breakdown and wanted to be treated like a baby. Moreover, many authors relayed too the babyyness of the males when they were sick. Johnson (2016) shared the comments of women about their husbands like “he is such a baby when he is sick, “I feel like I had another child” or “he acts like I am his mother.” Illness arguably reduced men on a state of imitative femininity, dependency on other for material support and for domestic care (Gestrich et al., 2012). However, the claim of the fathers in this study says even if they took care of their kids, yet they really longed for the care of their wives and hoped that their partners were present and do the care for the children. They shared they endured their pains and forced themselves to stand up so that they can serve their children. In Pillerterri (2010) it was cited that when fathers are ill, they do not have a back – up person for child care thus for the fathers in this study, being the only adults at home they do not have no choice because if they will not do the house chores especially in food preparation the children will have nothing to eat. Other fathers mentioned they tried not to be sick and prayed persistently so as to deliver them away from sicknesses. These behaviors of the fathers can be related to the claims of Heldan, (2009) that the poor has to deny sickness in order to survive and not to give up normal role responsibilities, but was expected to maintain normal behavior within the limits of their health condition.

**Considers wife is the best in child care**

Fathers' narratives were also their reflection on how they were as child carers when their wives were still around, and when alone taking care of the children. For some, mothers were still the best in child care, while others claimed they can never equal how women took care of children. This feeling of the fathers may be accounted on the research findings of Pruett (1997). Looking back at Pruett’s discussion it was mentioned that across many cultures fathers were present during pregnancy until delivery. However, after giving birth, mothers focused their attention to their newborns leaving fathers to have a feeling of backing off, feeling less control of their own lives or inadequate to the task at hand. The fathers in this study have this feeling during the initial migration of their partners but eventually became positive as they carried on their duties with their kids.

The perception of the fathers of being less skilled on child care than their partners was opposed to some study results since researchers claimed that parents have various ways of child care emphasizing that no one was better or worst. Close observation documents showed that even men who experience with children handled children differently from women, not worse, not better, but differently (Pruett, 1997). If ever there were dissimilarities, Thompson and Kramer (2002) cited there were only a few differences between a father and a mother on how they assisted their children in the activities of daily living while Cabrera and Tamis – Lemonda (2013) also affirmed that fathers and mothers influenced their children in similar rather than dissimilar way. In addition, Thompson and Kramer (2002) mentioned fathers were as likely as mothers to be helping in the self – care activities and supervision of meals, a description which was echoed by Cabrera, et al., (2007), when he noted, quality of father and mother’s parenting was very similar to each other.

Another research result revealed stay at home fathers do the same duties as a mother who cares for children – changing diapers, feeding, bathing, shopping and nurturing their children on a daily basis (Balter, 2000). This may be because in Pleck and Hofferth (2011) fathers’ modeled their behavior after mothers.

Despite the increasing number of hands on father, cultural stereotyping of fathers as providers and breadwinners continued to give much influence towards, women and children’s attitudes to fatherhood (Rowtee Foundation, 2000). This interchanging of gender roles in the family can impact positively or negatively depending on how the father who was left behind accepts his "new" role since parental absence creates "displacement, disruptions, and changes in care giving (Reyes, 2008). In Rosenberg et al. (2006) it was revealed that father's ability to provide and protect was still very much attached to the average men's sense of self - worth and manhood.

**CONCLUSION**

The fathers claimed that they were responsible for the well-being of their children. This was manifested through their involvement in the hygiene, nutrition, health, and studies of their children. More over, part of that responsibility was in ensuring that
their offspring will become children with the right attitude and conduct. To make this possible the fathers used their influence by instilling advices and at times gives minimal physical punishments and some verbal reprimands.

Various emotions were also revealed by the fathers when asked about how they felt when they took care of their children. Almost unanimous, they claimed, “It’s difficult.” For them it was difficult because they were not used to that kind of responsibility, difficult because of the overwhelming responsibility over the children. It was also difficult because of the household chores and the responsibility of helping the wives earn for their living. Despite the negative feelings, they also aired out happiness, fulfillment, satisfaction and pride.

Sickness of children was seen by the fathers as the most difficult part of rearing their kids, more so when they themselves are sick since no one will no longer do the household tasks that they are supposed to do.

The study also uncovered that most of the fathers medicated their children once sick after making their own diagnosis. Although there were also those who referred the sick child to medical facilities or resorted to traditional medicines.

Finally, despite the full involvement of the fathers in the over all well being of their children, they still claimed that their wives were still better than them in terms of child rearing. It was also interesting to note that these fathers were able to learn the tasks that were done by their wives when they were still around, tasks that were delegated to them or forced to them to do.

RECOMMENDATIONS

In the light of the findings recommendations were made such that, as the new role of fathers emerged, health workers and educators may also include them in the programs that they will develop. Moreover, in conducting a study about the perception of the children regarding their fathers as caretakers at home while their mothers are working abroad would also add on the limited literatures about fathers caring behaviors. Parenting education may also start earlier giving emphasis on the role of the fathers or mothers in today’s generation. In addition, it would be advantageous if government programs especially on the local levels will include the fathers on health care among children. These programs will be made available considering the sensitivity of the father’s roles and needs. And finally, there is a need to insist on a more accurate portrayals of fathers in the media so that representation of men as partners of wives, and as an involved and equal contributors to the care and upbringing of their kids will be promoted.

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Participation of Smallholder Vegetable Growers in High-Value Market Chains in Arusha, Tanzania

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**Abstract** Despite the huge employment and income benefits from vegetable farming, smallholder growers in developing countries lack the knowledge about high value markets and their requirements. Most of these growers are ignorant have limited knowledge about vegetable contract farming, product standardization and grading of their produce, quality of produce preferred by customers, on delivery times and food safety standards. This study used primary data collected from 200 smallholder vegetable growers in Arumeru District in Arusha Region to identify the determinants of high-value market participation of smallholder vegetable growers in high-value markets. The findings indicated that farmers income, distance from the farm to the main road and yield had a significant influence on smallholder cabbage growers’ participation in high-value markets to local markets. While for onion farmers, income, irrigation, extension services, and market information had a positive influence on farmers’ market participation. But as for tomato growers, experience, the distance to high-value market, yield, and irrigation had significant influence on growers’ participation. These findings demonstrated the urgent need to deliberately improve the factors that increase participation of smallholder growers in high-value markets if they are to get stable incomes and sustain their livelihoods. There is also a need to improve access to market information, develop farmers’ business skills and improve rural access roads.

**Index Terms** - Smallholder growers, high-value markets, market participation, vegetables.

I. INTRODUCTION

Vegetables are the most important ingredients in human diets for the maintenance of good health and prevention of diseases. Besides nutritional value, cultivation of vegetables has been an excellent source of employment for both rural and urban dwellers as it takes place in many rural areas and in the outskirts of towns and cities in the form of backyard gardening, to supply fresh produce to urban markets (Chagomoka, et al., 2014). Thus vegetable farming plays an important socio-economic role for small farmers as well as in diversifying diets to improve their nutrition.

In the last two decades, production and consumption of vegetables in Tanzania has been on the increase especially in peri-urban and urban areas due to increase in consumers’ nutritional awareness and disposable income (SCF, 2008). This is due to good climatic conditions that favor the growth of vegetable throughout the year. In Arusha Region, the agro-climatic conditions are suitable for growing various vegetables such as amaranths, cabbage, carrot, chilies, cucumber, eggplant, okra, onion, radish, spinach, tomatoes, and turmeric (Lyatuu et al., 2009). The suitable growing conditions offer a huge opportunity for the development of sustainable vegetable production. In addition, good supply of water for irrigation purposes, good extension services and availability of vegetable seeds from several research institutes in the area support production of different vegetables on a continuous basis (Tenkouano, 2013). Moreover, fast growth of supermarkets, schools and colleges, tourist hotels, and green grocer shops in the area offers smallholder vegetable growers many opportunities to sell their produce and thus generate higher income if these vegetables meet quality and quantity demanded (Irungu et al., 2011). These new growing vegetable outlets are known as high-value markets. High-value markets are markets were simple activities such as grading, sorting, cleaning, chopping, mixing, packing, and labeling are carried out to add value (Chagomoka, 2014).

However, access to market opportunities for the small vegetable growers remains a major problem for small value chain players in the vegetable sub-sector. According to Jones (2015), findings show some issues such as poor infrastructure, grading systems, inadequate storage facilities, insufficient market information and communication between farmers, traders and consumers pose a significant hindrance to market accessibility. Other studies have found out that smallholder vegetable farmers face a limited access to farm credit due to high interest rates attached to these loans (Shute et al., 2011). All these factors in combination limit smallholder farmers to participate effectively in and benefit equitably from high-value chains that serve either the local, regional or international markets.
Despite these problems, the market share of supermarkets in the vegetable and fruit sector is growing rapidly in Tanzania, most of the vegetables that were sold in the local spot markets are now mostly sold through supermarkets (Chagomoka, 2014). Many consumers prefer shopping at supermarkets these days because they are assured of the quality of the product, good customer service, cleanliness, food safety, variety of product and good packaging (Irungu et al., 2011). Therefore, improving market access for smallholder growers has a great potential to improve incomes for small vegetable producers and traders (Kuzilwa et al., 2013).

The aim of this study was to determine factors that could increase smallholder vegetable growers’ participation in high-value market opportunities in Arusha Region. According to the National Bureau of Statistics census conducted in 2008, the three highest ranked grown vegetables were tomatoes, onions, and cabbage respectively. Therefore this study generated information that could help smallholder growers along the three (tomatoes, onions, and cabbages) vegetable value chains to adopt an attitude of producing what they can sell for premium prices, rather than merely sell whatever they were used to grow often getting lower prices for their produce like any other fellow growers.

II. METHODOLOGY

Study area
The study population was vegetable farmers in Arumeru Districts in Arusha Region, Tanzania. Using a cross sectional approach, primary data was collected at one point in time through formal survey to get an in-depth understanding of factors influencing smallholder vegetable growers’ participation to high-value market opportunity. A sample of 200 vegetable farmers growing vegetables were interviewed (110 tomato, 50 cabbage and 40 onions). The main criteria for selection of the district and the villages were based on growers’ involvement in a project called “Improving Incomes and Nutrition in Eastern and Southern Africa by Enhancing Vegetable-based Farming and Food Systems in Peri-urban Corridors” (VINESA). This project is managed by the World Vegetable Center and funded by the Australian Centre for International Agricultural Research (ACIAR). VINESA was established in June 2013 and has equipped over 500 youth with skills to generate employment and income opportunities for peri-urban vegetable growers and their families in Ethiopia, Malawi, Mozambique and Tanzania.
Analytical Approach

The study used binary logistic regression model to determine factors that influence smallholder vegetable grower’s to participate in high-value market opportunities. The participation in the high-value vegetable market was analyzed as a dichotomous response variable where a farmer either willingly chooses to participate in high-value vegetable markets or local markets.

The utility maximization of smallholder growers was explained as follows;

The function was specified as:

\[ \text{Max}(U) = U(FC_{ji}, TA_{ji}) \]

Where \( U_i \) is the non-observable utility function that ranks the preference of the \( i^{th} \) farmer for the \( j^{th} \) market (\( \forall j = 1, 0 \); 1 for high-value vegetable markets and 0 for local vegetable market. FC is defined as farm and farmer specific attributes and TA is defined as other attributes of the innovation that may be unobserved to the analyst but observed and acted upon by the decision markers. The basic assumption in Equation (1) is that farmers perceive high-value as an optimal course of action to maximize their expected utility.

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and decision is made in situation where the decision maker is full aware of this high-value markets and its attribute. Therefore, the utility derived from \( j \)th market is a function of FC, TA and a disturbance term with zero mean. Equation (2) can be presented as:

\[
U_{ij} = \alpha_j F_i(M_i, A_i) + e_{ij} \forall (j = 1,0; \ i = 1,2, \ldots , n)
\] (2)

Since the utilities \( U_{ij} \) are random, the \( j \)th farmer was selected the alternative \( j = 1 \) when \( U_{1i} > U_{0i} \) or the non-observable (latent) random variable \( Y^* = U_{1i} - U_{0i} > 0 \) the probability that \( Y_i = 1 \) (Thus, farmer opts for participating in high-value market) is a function of the independent variables and is represented as:

\[
P_i = P_r(Y_i = 1) = P_r(U_{1i} > U_{0i})
\]

\[
= P_r[\alpha_1 F_i(M_i, A_i) + e_{1i} > \alpha_0 F_i(M_i, A_i) + e_{0i}]
\]

\[
= P_r[e_{1i} - e_{0i} > F_i(M_i, A_i)(\alpha_0 - \alpha_1)]
\]

\[
= P_r[\mu_i > F_i(M_i, A_i)\beta]
\]

\[
= F(X_i\beta) \tag{3}
\]

Where \( X \) is the \( n \times k \) matrix of the explanatory variables and \( \beta \) is a \( k \times 1 \) vector of parameters to be estimated. \( P_r(\cdot) \) is a probability function, \( \mu_i \) is an error term following logistic distribution, and \( F(X_i\beta) \) is the cumulative distribution function for \( \mu_i \) evaluated at \( X_i\beta \). The specification in Equation (3) indicates that the probability that a farmer participated in high-value vegetable market is a function of the vector of explanatory variables, unknown parameters, and the error term. However, the specification in equation (3) cannot be estimated directly unless the functional form of \( F \) and the distribution of \( \mu_i \) are known.

From equation (4), the regression model was specified as follows:

\[
P_r(Y_i = 1) = F(X_i\beta) = \frac{\exp(X_i\beta)}{1+\exp(X_i\beta)} \tag{4}
\]

Where, parameter \( \beta \) were estimated by maximum likelihood estimator MLE. Therefore the logit equation will be

\[
\text{Logit}(P_i) = \ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \sum_{i=1}^{12} \beta_i \chi_i + \epsilon
\]

Whereby;

\[
\ln\left(\frac{P_i}{1-P_i}\right) = \text{logit for market participation}
\]

\( P_i \) = participating in high-value markets

\( 1 - P_i \) = not participating in high-value markets

\( \chi_i \) = independent variables

\( \beta_i \) = parameters to be estimated

\( \epsilon \) = error term

The specification of variables used in the binary logit model for market participation by vegetable growers (Table 1).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Description of Variables</th>
<th>Expected Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable ( (P_i) )</td>
<td>1 if farmer participates in high-value market; “0” Otherwise</td>
<td></td>
</tr>
<tr>
<td>Sex ( (X_i) )</td>
<td>Sex (0=female, 1=male)</td>
<td></td>
</tr>
</tbody>
</table>
III. RESULTS AND DISCUSSION

Social-Economic Characteristics of the Respondent

The age of respondents ranged from 18 years to 60 years. 46.5% of all vegetable farmers were aged between 31 and 45 years (Table 2). The size of this active age group holds promise for vegetable cultivation in the study area because most farmers at this age are mature, they have a source of income for inputs and they have strength to work on their farms. This age profile is similar to that found by Makarau (2013). Most of the respondents were males (Table 2). Since the bulk of the respondents (60.5%) are heads of household, therefore, vegetable production in the study areas are male dominated.

<table>
<thead>
<tr>
<th>Table 2: The Age of Respondents in Response to Their Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>--------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>female</td>
</tr>
<tr>
<td>male</td>
</tr>
</tbody>
</table>

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About 55% of vegetable farmers in the area planted tomatoes (Figure 2). 25% and 20% of the vegetable farmers grew cabbage and onion respectively. Tomato vegetable is the most used vegetable in cooking and preparation of salads at homes, school cafeterias, restaurants and hotels on a daily basis. For onions, farmers could store their produce for up to three month before selling, hence giving them enough time to seek for good markets before selling their produce. This is not possible for tomatoes and cabbage due to their high perishability nature.

For smallholder tomato farmers only 15% out of 55% of all tomato farmers sold their vegetables in high-value market while 40% sold their produce to the local markets (Figure 3). These farmers fail to meet conditions that were set by high-value markets such as grades, quality, timely and consistent supply, safety, packaging, and cleanliness. Hence farmers find it easier to sell their tomatoes to local markets were no criteria are required to be met but they end up fetching a lower price for their produce. For the case of cabbage farmers it was different because out of 25% of all interviewed cabbage farmers 14% sold their produce to high-value markets and only 11% sold their produce to local markets (Figure 3). These farmers who sold their cabbage to high-value markets mostly sold it to secondary schools cafeterias and few sold them to supermarkets and hotels. For onion farmers 12.5% out of their total 20% sold their onions to the local markets near due to lack of storage facilities and poor market information. Only 7.5% of these onion farmers sell their onion to the high-value markets where they received good prices for their produce (Figure 4).

<table>
<thead>
<tr>
<th>Total</th>
<th>26.5</th>
<th>46.5</th>
<th>27</th>
<th>100</th>
</tr>
</thead>
</table>

Figure 2: The percentage growth of vegetables grown by farmers in the study area.
The Determinant Factor to Market Participation

The determination of factors that influencing smallholder growers to participate in high-value markets were estimated by using binary logistic regression model to establish which factors were significantly influential to smallholder growers "participation in high-value markets". The model was statistically significant at (ρ<0.05) with entered variables in Table 3.

**Table 3: Binary logit regression results**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cabbage Growers (n=50)</th>
<th>Onion Growers (n=40)</th>
<th>Tomato Growers (n=110)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Sig</td>
<td>β</td>
</tr>
<tr>
<td>Sex</td>
<td>-0.904559</td>
<td>0.17</td>
<td>-0.9577485</td>
</tr>
<tr>
<td>Education</td>
<td>0.9805321</td>
<td>0.593</td>
<td>0.540729</td>
</tr>
<tr>
<td>Income</td>
<td>0.0000118**</td>
<td>0.031</td>
<td>4.79E-06****</td>
</tr>
<tr>
<td>Credit</td>
<td>0.210943</td>
<td>0.876</td>
<td>-0.162751</td>
</tr>
<tr>
<td>Experience</td>
<td>0.012643</td>
<td>0.862</td>
<td>0.0784212</td>
</tr>
<tr>
<td>Dist_mainroad</td>
<td>-0.63247**</td>
<td>0.02</td>
<td>0.5369563</td>
</tr>
<tr>
<td>Dist_localmkt</td>
<td>0.4197783</td>
<td>0.199</td>
<td>0.295872</td>
</tr>
<tr>
<td>Dist_hvm</td>
<td>-0.946779</td>
<td>0.192</td>
<td>-0.3517437</td>
</tr>
<tr>
<td>Yield</td>
<td>0.0014439**</td>
<td>0.04</td>
<td>-0.0368661</td>
</tr>
<tr>
<td>Irrigation</td>
<td>0.8999083</td>
<td>0.414</td>
<td>-0.597099**</td>
</tr>
<tr>
<td>Ext_service</td>
<td>-0.164172</td>
<td>0.341</td>
<td>0.997531**</td>
</tr>
<tr>
<td>Mkt_info</td>
<td>0.456493</td>
<td>0.304</td>
<td>0.706696</td>
</tr>
<tr>
<td>_cons</td>
<td>-0.579375</td>
<td>0.729</td>
<td>-0.704932</td>
</tr>
</tbody>
</table>

Log likelihood = -19.355503
Log likelihood = -10.811212
Log likelihood = -33.972787
Pseudo R$^2 = 43.9$
Pseudo R$^2 = 59.15$
Pseudo R$^2 = 47.55

* means significant at ***=1%, **=5%, * = 10% level of significance
The binary logit regression estimation in Table 3 shows that the estimated coefficients of the Logit regression revealed that the explanatory variables ‘income’, and ‘yield’ positively and significantly influence the cabbage farmers’ decision to participate in the high-value market, while ‘distance to the main road’ has a negative influence on cabbage farmers high-value market participation. On the other hand, ‘income’ and ‘extension service’ has significant positive impact on the decision of the smallholder onion farmers to participate in the high-value market, while ‘irrigation’ had a negative effect. For the case of tomato farmers, ‘experience’, ‘yield’, and ‘irrigation’ influenced positively smallholder tomato farmers participation in high-value market, while, ‘distance to the high-value market’ had a negative significant effect to farmers market participation.

Income for cabbage farmers, and yield were positive and statistically significant at (\(p<0.05\)) related to the farmers participation in high-value market. This implies that a unit increase in income and a unit increase in yield increases the probability of these vegetable growers to participate in high-value market by 0.0000118\% and 0.0014439\% respectively keeping all other factors constant. While the distance from the farm to the main road had a negative relationship to high-value market access by smallholder vegetable growers, and was statistically significant at (\(p<0.05\)). This implies that a unit increase in distance decreased the probability of cabbage growers to participate in high-value market by 0.63247\% keeping all other factors constant.

Growers with more income and high yield were more likely to participate in high-value market opportunities found in Arusha Region than their counter parts. High-value markets need a constant supply of quality produce of vegetables (Chagomoka, et al., 2014). Nevertheless distance from the farm to the main road has a negative relationship, meaning growers whose farms are far from the main road are less likely to participate in high-value market opportunities than growers whose farms are near to the main road. This is due to poor infrastructure and high transportation cost for farmers.

Table 3 results shows that, income, extension service and market information were positive and statistically significant at (\(p<0.001\)), (\(p<0.05\)), and (\(p<0.1\)) respectively related to smallholder onion growers participation in high-value market. This implies that a unit increase in income, extension service and market information, increases the probability of smallholder onion growers participation in high-value market by 0.00000479\%, 0.997531\%, and 0.706696\% respectively. Irrigation for onion growers had a negative relationship and significant at (\(p<0.05\)) related to smallholder growers participation in high-value market. This implies that a unit increase in irrigation decreased the probability of smallholder onion growers’ participation to high-value market by 0.597099\% holding all other factors constant.

Smallholder growers who irrigated their onions were less likely to get more yields and participate in high-value market. Many smallholder growers who practice irrigation they practice it in a small area of land that has access to irrigation water compared to growers who wait for the rainfall to cultivate their onions. While an increase in extension service increases smallholder onion growers participation to high-value markets. Extension Services helped growers to be aware of the use of inputs and even how to grow their produce and protect them from pest and diseases so that they can harvest more quality produce compared to growers with no extension services. Growers with market information were more likely to participate in high-value markets than growers with no market information. Market information included where to sell, price, and quantity required. Therefore a farmer is free to make decision of where to sell his produce so as to fetch higher prices.

However, for the case of tomatoes table 3 results indicated that experience was positive and statistically significant at 10\% (\(p=0.1\)) to growers participation in high-value market. A unit increase in experience increased the probability of participating in high-value market by 0.0890367\% holding other factors constant. Experienced growers have more market information, and product information compared to unexperienced growers.

Distance to the high-value market for smallholder tomato growers was negative and statistically significant at 5\% (\(p=0.037\)) to growers participation in high-value market. This implies that a unit increase in distance from the farm to the high-value market decreased smallholder growers participation to high-value market by 0.0924765\% holding other factors constant. The more the distance to the high-value market the less tomato growers are going to sell their produce to those markets. This is due to poor infrastructure, high transportation cost and the perishability nature of vegetables.

Tomato yield and irrigation were positive and statistically significant at 1\% (\(p=0.000\)) and 10\% (\(p=0.071\)) respectively. A unit increase in tomato yield increase smallholder growers participation to high-value market by 0.0147061\% holding all other factors constant. This finding is consistent with Reyes et al. (2012) and underscores the importance of increased output by smallholders’ farmers to enhance their changes of stepping out of poverty and improving their livelihood through increased income from increased participation in the market. While a unit increase in irrigation by smallholder vegetable growers increases smallholder growers participation in high-value market by 0.369579\% holding all other factors constant. Growers who irrigate their tomatoes are more likely to increase their yield and they are free to cultivate even when it is off season. These growers are more likely to participate in high-value markets because they are assured of constant supply of tomatoes to these high-value markets than growers who do not irrigate.
IV. CONCLUSION AND RECOMMENDATIONS AND POLICY RECOMMENDATIONS

In this study, male participated more in vegetable production than female farmers because vegetable is a high income crop that has a short maturity compared to most of staple crops. Also male farmers have more contacts that are social with both vegetable buyers and their agents whom they often meet in trading centers. Female farmers lack such contacts and are in most cases excluded from direct transactional negotiations with buyers. Thompson (2013), found that male farmer positively and significantly influenced farmer’s volume of vegetable sales in the market. The author stated that the reason is that women spend much of their time doing domestic work and allocate less time to other matters like market transactions.

Moreover, for cabbage growers’ income, distance from the farm to the main road and yield, were found to significantly affect smallholder vegetable growers’ participation in high-value markets such as supermarkets, tourist hotels and greengrocer shops. While for onion income, irrigation, extension services and market information were significant. And for tomato, experience, distance to the high-value market, yield, and irrigation were significant. Experienced growers benefited from their skills on producing vegetable products that meets the needs of their target customers as compared to the less experienced growers. Similarly, smallholder vegetable growers whose produce travel shorter distance from the farm to nearby high-value markets are more likely to sell their produce to these markets. Other close by market outlets includes schools and hotels that are surrounding local growers thus offering bulk purchase opportunities and therefore more income. Finally, growers with more yields are more likely to participate in high-value market opportunities as compared to those smallholder growers with lower yields for these crops since they can meet the market demand.

There is a need to deliberately improve the numbers of smallholder growers participating in and benefiting from the high-value markets in order to facilitate stable incomes and sustainable livelihoods. To achieve this, the following preconditions are recommended (i) strengthening of extension services by the government and other stakeholders especially to cabbage and tomato vegetable growers in order increase growers’ access to improved production technologies and practices, (ii) smallholder vegetable growers should be educated about value addition, standardization, grading, proper cleaning, packaging, and the advantages of producing quality produce in order to win the available high-value markets in their areas. Research and development programmers should be geared towards solving production and marketing constraints facing many small vegetables growers today such as good seeds, fertilizers, training and market information. In addition, improving rural infrastructure (e.g., access roads) would facilitate faster delivery of farm produce (especially perishable commodities such as vegetables) to reach consumers in fresh state.

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Profitability analysis of Sustainable Agriculture Practices to Smallholder Maize Farmers in Kilosa District Tanzania

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ABSTRACT

This study determines smallholder farmer’s decision to adopt of sustainable agriculture practices (SAPs) based on the assessment of profitability margin among smallholders SAPS adopters and Non adopters in Kilosa district, Morogoro. A total of 550 respondents were chosen for the study after a random sampling of the baseline dataset as a follow-up to SIMLESA adoption pathway project. Gross margin was developed using plot-level data gathered from maize farmers in Kilosa Tanzania. The results showed that smallholders SAPs adopters recorded a relatively higher gross margin compared to the non-adopters. The reason for the difference in gross margin is that most of the smallholder’s maize farmers weren't exposed to the extension services thus they became unaware of the technologies’ attributes which limited their ability to make decision on whether to adopt SAPs. Furthermore, high prices attached to the farm inputs were mentioned to be among the factors affected farmer’s decision to adopt SAPs. Thus, decision to adopt SAPs was largely influenced by the profit margin between different practices and that a farmer is likely to adopt SAPs after comparing the returns obtained to a number of agriculture practices. The results provide insight into the further efforts needed to encourage greater adoption of SAPs in Tanzania.

Index Terms: SAPs, Adoption, and Profitability margin

1. INTRODUCTION

Smallholders farmers have been considered as a backbone of the Tanzania’s economy for decades as a majority of people who are farmers have fallen into this category. In spite of the contribution of smallholder farmers to the economy and food security, still they haven't come close to reach the potential farm produce due to the social-economic factors such as education, income, and extension services to name the few along with the need to be exposed to suitable agriculture practice that would maximize the farm produce and protect the environment. These Sustainable practices are not well known to farmers due lack of communication and for financial reasons. SAPs being one of the most profitable and friendly practice has not been widely adopted by the majority smallholders farmers especially in rural areas despite of the advantageous outcomes to smallholders farmers welfare and production.

Sustainable Agricultural Practices (SAPs) that lead to an increase in productivity are central to the acceleration of economic growth and economic development; that might help alleviate poverty and overcome the recurrent food shortages that affect millions of households in Tanzania and Africa in general (Kassie, 2012). According to Pretty et al. (2011), despite the improvements made over the last four decades in the agricultural and industry sectors, a combination of declining soil fertility, population growth, low uptake of external inputs, and climate disruption have resulted in a dramatic fall in per capita food production in most of the African countries.

According to the Food and Agriculture Organization (FAO) (1989), sustainable agriculture consists of five major attributes: (i) it conserves resources, (ii) it is environmentally non-degrading, (iii) it is technically appropriate, (iv) it is economically and, (v) socially acceptable (Kassie et al., 2012). Accordingly, these practices broadly defined may include conservation tillage, legume intercropping, legume crop rotations, improved crop varieties, the use of animal manure, the complementary
use of inorganic fertilizers, soil and stone bunds for soil and water conservation (Lee 2005, Kassie et al., 2010; Wolni et al., 2010).

The importance of farmer's decision to adopt new agricultural practices and technologies has long been of interest to agricultural extension agents and economists as it is reported that the solutions could be of help to alleviate the current production setbacks. According to Oladele (2005), several parameters have been identified as influential factors to the adoption behavior of smallholders farmers from qualitative and quantitative models. Researchers investigating farmers adoption behavior have accumulated considerable evidence showing that information on profitability margin of agriculture practices have an effect on the farmer's decision to adopt particular sustainable agriculture practice (Oladele, 2005; Byakugila et al., 2008). Nevertheless, for the smallholder’s farmer’s decision to adopt a particular technology to be successful, it has to be supported by the extension agents.

The Profitability margin derived from maize production depends on the type of agriculture practice adopted by a smallholder farmer for that particular cropping year (Lugandu, 2013). Nevertheless, maize growing zones in Tanzania are different since maize varieties requirements such as soil and climate differs with agro-ecological zones, differences in the characteristics of ecologies in Tanzania have necessitated farmers to have appropriate knowledge on suitable agriculture practice for their maize production in respective of the ecological zones for better and consistent performance in terms yield and income generation.

These SAPs technologies are made and developed in different areas specialized in the sector such as the zonal research centers and thereafter disseminated to the farmers through extension services as one of the effective means. However, decision on how to integrate these sustainable agricultural practices into their individual farms depends on farmer’s choice as well as the technology and its specific attributes along with the profitability of the technology that a farmer expects to acquire after the adoption may play an integral part to farmer's decisions.

Despite the demonstrated positive impacts of sustainable agriculture practices in terms of yield and returns, SAPs dissemination has been met with some resistance during the whole process of adoption (Chiputwa et al., 2011). Where the adoption has been observed, not all components of SAPs have been adopted due to biophysical factors (soils, climate, and topography), socio-economic factors, institutional factors and technology characteristics (Baudron et al., 2007) without forgetting unavailability of appropriate policies to support the SAPs dissemination to the targeted population.

Currently little is known about SAPs adoption in Kilosa in terms of profit margin and its effects on the adoption behavior of smallholders farmers to the adoption SAPs, yet better knowledge of how profit margin affect adoption would help policymakers and researchers in designing more effective technologies that will be tailored to the needs of the farmers.

The main objective of the study is to Determine the adoption level of sustainable agriculture practices and profitability margin for the adopters and non-adopters of SAPs among smallholder farmers in Kilosa District, in archiving the objective, the information obtained will help to raise awareness among stakeholders especially policy makers and implementers on variables crucial for implementation of the adoption of sustainable agriculture practices and be able to design policies or strategies that enhance adoption of sustainable agriculture practices through use of profitability variables of agriculture practices.

II. METHODOLOGY
This study was conducted in Kilosa Districts in Morogoro Region, Tanzania. The location was selected because it's the potential maize producing district, moreover maize was chosen since it is the main crop promoted for food security in the District. 550 smallholder maize farmers from the village household register were chosen after a random sampling. This was a follow-up study to SIMLESA project to trace farmers who were exposed to SAPs in the study area. For the sampled household, the head or his representative was interviewed. The Gross Margin was used to compute the production costs against the revenue for the adopters and non-adopters of SAPs. Nevertheless, Gross margin was used for the analysis since it enables to compare the relative profitability of alternative cropping options that have similar land, machinery, and equipment requirements. They indicate the costs of production of alternative agriculture, which helps to make farm management decisions. It is useful in analyzing the performance of individual agriculture technology and discovers areas where you can possibly make improvements. Analysis of the level of adoption and the socio-economic profiles of adopters and non-adopters of SAPs was carried out using descriptive statistics including frequencies, mean, and standard deviation.
To determine the intensity level of the adoption of sustainable agriculture practices in maize production, the following model was used:

\[ \text{Adoption level} = \frac{\text{Areas cultivated with SAPs}}{\text{Total Areas cultivated}} \times 100 \] \hspace{1cm} (1)

The mathematical notation for calculating the Gross margin is given by the equation below:

\[ \text{GM} = \text{P}_1 \text{Y}_i - \text{R}_i \text{C}_i \] \hspace{1cm} (2)

Where:

- \( \text{GM} \) = Gross margin
- \( \text{P}_1 \text{Y}_i \) = Total revenue
- \( \text{R}_i \text{C}_i \) = Total variable cost
- \( \text{P}_1 \) = Farm price of maize produce
- \( \text{Y}_i \) = Output of maize produce
- \( \text{R}_i \) = Price of variable input used
- \( \text{C}_i \) = Quantity of the variable input used (Kgs)
- \( \text{TVC} \) = Total variable cost

\[ \text{TVC} = \text{X}_1 + \text{X}_2 + \text{X}_3 + \text{X}_4 + \text{X}_5 + \text{X}_6 + \text{X}_7 \] \hspace{1cm} (3)

Where: (values are in Tshillings)

- \( \text{X}_1 \) = Cost of seedlings
- \( \text{X}_2 \) = Cost of fertilizers
- \( \text{X}_3 \) = Cost of labour
- \( \text{X}_4 \) = Cost of transport
- \( \text{X}_5 \) = Cost of herbicides
- \( \text{X}_6 \) = Cost of pesticides
- \( \text{X}_7 \) = Other variable cost

Gross Margin = TR - TVC

Net Profit = GM - TFC

The difference of statistical means was used to test whether there is a significant difference in the net profit of adopters and non-adopters of SAPs farming system. It was tested thus:

\[ \text{T} = \frac{X_i - X_j}{\sqrt{\frac{s^2_i + s^2_j}{n_i + n_j}}} \]

Where:

- \( X_i \) = Mean net profit for the adopters
- \( X_j \) = Mean net profit for the non-adopters
- \( s^2_i \) = Sample variance for the adopter
- \( s^2_j \) = Sample variance for the non-adopters
- \( n_i \) = Number of adopters
- \( n_j \) = Number of non-adopters

III. RESULTS AND DISCUSSION

Table 1: Distribution of respondents by social and economic characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Nonadopters %</th>
<th>Adopters %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50</td>
<td>64</td>
</tr>
<tr>
<td>Female</td>
<td>50</td>
<td>36</td>
</tr>
</tbody>
</table>

http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7654
Socio-Economic Characteristics of the Respondents

The socio-economic characteristics presented under this section include: age of the respondents, gender, marital status of respondent, educational level of respondent, land size, household size, and household income.

Age of the respondents

The survey results for the adopters of SAPs respondents indicate that, there is small number of people engaged in farming activities at the age above 61 years (Table 3). This can be explained by the fact that inadequacy in physical strengths to perform agricultural activities and other farm managements, thus they tend to entrust them to other family member of younger age. According to Basnayake and Gunaratne (2002), the age of a person is usually a factor that can explain the level of production, efficiency and adoption of SAPs.

Findings show that the majority of respondents lie between the ages of 41-50 for the SAPs adopter's farmers. According to the study conducted by Nyanga (2012), stipulated that frequently cited reason behind the numbers is due to the migration of young people from rural to urban areas searching for the jobs and other off-farm activities such migration is also under the influence of the limited land in the rural areas. Nevertheless, results indicate that few people engaged in farming activities at the age between 21-30 and 31-40 for adopters as the majority of them were students or employed to other off farming activities.

Table 2: Distribution of respondents by age

<table>
<thead>
<tr>
<th>Age</th>
<th>Percentages SAPs farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30 (N=38)</td>
<td>7</td>
</tr>
<tr>
<td>31-40 (N=159)</td>
<td>29</td>
</tr>
</tbody>
</table>

Gender status of the respondents
Findings indicate that majority of the respondents were males, who represents 48% and 52% for female and male respondents respectively (Table 4). Moreover, this implies that many smallholders family are male headed households. The low representation of women could be attributed to cultural barriers (Norman, 2005) where women are considered household heads only when they are widowed, divorced or separated or single. Furthermore, the involvement of women in farming activities is normally constrained by their cultural division of labor, responsibilities and the control and use of income which have widespread implications in agricultural production in adopting the SAPs in the study area.

Table 3: Proportion of respondents by Gender

<table>
<thead>
<tr>
<th>Sex</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAPs farmers</td>
<td></td>
</tr>
<tr>
<td>Males (N=286)</td>
<td>52</td>
</tr>
<tr>
<td>Females (N=264)</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

4.1.3 Marital status of the respondents
The majority of respondents were married (50%) (Table 5) the results can be explained by the fact that, most of the respondents in rural area are married at very young age as the tradition and customs are there to support such commitments and these marriages are mostly done when people have reached grade 7 classes thus unmarried young men and women are generally at low compared to the married ones. Hence the availability of labour was assured to undertake the adoption of SAPs in the study area.

Table 4: Distribution of respondents by marital status

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAPs farmers</td>
<td></td>
</tr>
<tr>
<td>Single (N=126)</td>
<td>23</td>
</tr>
<tr>
<td>Married (N=275)</td>
<td>50</td>
</tr>
<tr>
<td>Widow (N=28)</td>
<td>5</td>
</tr>
<tr>
<td>Separated (N=121)</td>
<td>22</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Education level of the respondents
From the results in (Table 6), 78% of SAPs adopters had primary school education, 14% had secondary school education, 3% had a university school education and 6% did not attend to school. Furthermore, based on these findings, one could infer that farmers with high level of education marginally had more knowledge and information on good SAPs practices, coping and adaptation strategies and, those farmers with tertiary education were able to synthesize information much better than those who had no formal education or illiterate.

Table 5: Education level of the respondents

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAPs farmers</td>
<td></td>
</tr>
<tr>
<td>No formal Education (N=33)</td>
<td>6</td>
</tr>
<tr>
<td>Primary school (N=429)</td>
<td>78</td>
</tr>
<tr>
<td>Secondary school (N=77)</td>
<td>14</td>
</tr>
<tr>
<td>Beyond Secondary (N=11)</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>
Main occupation of the respondents
From (Table 7) the result shows that farming was found to be the main occupation for the majority of respondents by 90%. Results further reveal that 4%, 2%, and 4% represents petty business, carpentry, and employment respectively as the main occupation of SAPs respondents. Most of the respondents were found to be self-employed because most of them have reached low level of education hence become unable to get a sufficient job opportunity to invest more on activities relating to the adoption of SAPs in the study area.

Table 6: Distribution of respondents by their main occupation

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAPs farmers</td>
<td></td>
</tr>
<tr>
<td>Self-Employment (N=523)</td>
<td>95</td>
</tr>
<tr>
<td>Petty business (N=11)</td>
<td>2</td>
</tr>
<tr>
<td>Carpentry (N=5)</td>
<td>1</td>
</tr>
<tr>
<td>Employed (N=11)</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

Household size of the respondents
The average household size had higher percentage of 5-7 members. Results from this study indicated that number of members in the family had an influence in assisting the whole need process of the adopting SAPs technologies especially if members fully participate in farming activities (Lugandu, 2013). Nevertheless, these findings implies that, households with large family size were more likely to engage in adopting the SAPs, take advantage of high production in agriculture and are more likely to adapt to new agricultural technologies.

Adoption Level of Sustainable Agriculture Practices among Small Holders Farmers
The adoption levels of sustainable agriculture practices were different among smallholders’ farmers in Kilosa District.
Figure 1: Adoption level of sustainable agriculture practices

(i) **Crop rotation:**
Smallholders’ maize farmers had different combination of crops that were rotated once the main season was over including common beans and pigeon peas. However the adoption level was particularly low as only (25%) of the respondents were able to adopt compared to non-adopters (75%). The reason for the low adoption is contributed by the effect of climate change on the farming activities, under such circumstances some of the crops may not be able to cope with the changes that come along with the climate change such as inadequate rainfalls or drought.

Furthermore, according to Wollni (2010) poor soil and environmental management have been said to be cause for the low adoption as many farmers opted to leave the farms unfarmed for a while so as to preserve the needed fertility for the next season.

(ii) **Intercropping:** as one of the sustainable agriculture practices technologies which is used by the majority of smallholders farmers to preserve the environment and increase the yield. It’s one of the possible techniques to avoid the risk of climate change such as drought for the majority of farmers who depend on rain-fed agriculture.

However, the adoption level is significant low (19.2%) among the smallholders’ farmers compared to (81.8%) who did not adopt the technology. According to the interviewed extension agent, the reason for the low adoption is due to different soil characteristics in their farms which do not allow other crops to be grown in such area hence become a limiting factor to the farmers. Nevertheless, Lack of extension services in rural areas has played a significant role for the SAPs not to be fully adopted as farmers became unaware of the ongoing changes in techniques and information.

(iii) **Soil and Water Conservation**
Soil and water conservation methods have not been well known among smallholders’ farmers in the rural areas. Most of the farmers weren’t aware of the soil and water conservation methods as the adoption level was low to (13%) while the remaining (87%) did not adopt the technology. According to the study done by Perseverance (2012) the reason for the low adoption is due to lack of provision of extension services to smallholder's farmers. Farmers became unaware of the methods since the extension agents are far from delivering the information and advice along with demonstration to their fields due to the distance from the office to the farms. Furthermore, Nyanga (2012) argued that, farmers who rented land paid no attention to the soil and water conservation techniques during the period of farming as most of them were encouraged to use more chemicals to maximize the yield thus destroying the natural fertility of the land.
(iv) Minimum Tillage
As opposed to conventional practices that includes intensive tillage technique which changes the cover and structures the soil but, under minimum tillage the soil cover is not disturbed thus the effect is so minimum and enough for the successful production to take place.

The adoption rate is very low among small holders farmers as (6.7%) of the respondents were the ones who adopted the technology while (93.3%) respondent did not adopt the technology. Kshirsagar (2002) reported that, the reason for the low adoption is due to its inability to cooperate well the soil with agrochemicals/inputs to produce sustainable yields unlike intensive technique once the chemicals or seeds are applied they tend to corporate well with the soil and hence gives higher possibility of achieving the intended return. Nevertheless, lack of extension services in the study area played a role to the low adoption rate as 93.3% respondents did not receive training, advice and information from the extension agents.

(v) Crop residual leftovers
Crop residual refers to what is left on the field when the harvest in done, the remains of the harvested plant. This is one of conservation methods which have been used to conserve soil from being destructed by natural and manmade causes.

Nevertheless, adoption of the technology among smallholder’s farmers is low (16%), and the majority (84%) of the farmers did not adopt the technology. The study done by Lugandu (2013) defined the reason for the low adoption due to the presence of conventional agriculture inputs such as chemicals, fertilizers which compensate the use crop residuals in other activities apart from conserving the environment. Many respondents didn’t apply the technology because, crop residuals had multiple uses, one of them was being used as a source of income once it was sold nevertheless it was also used to feed the livestock such as large and medium size livestock.

<table>
<thead>
<tr>
<th>Sustainable Agriculture Practices</th>
<th>Adopters (%)</th>
<th>Non Adopters (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop rotation</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>Intercropping</td>
<td>19.2</td>
<td>81.8</td>
</tr>
<tr>
<td>Soil and water conservation</td>
<td>13</td>
<td>87</td>
</tr>
<tr>
<td>Minimum tillage</td>
<td>6.7</td>
<td>93.3</td>
</tr>
<tr>
<td>Crop residues</td>
<td>16</td>
<td>84.0</td>
</tr>
</tbody>
</table>

Adoption Level of SAPs package in Kilosa District
It was observed that 22% of the interviewed households in Kilosa districts are practicing conventional or other farming practices, which imply that they don’t abide to any of the three SAPs principles. This means farmers mostly practice monoculture, do not grow soil cover crops, and use conventional tillage practices in their fields. Conventional farming practices such as intensive tillage and burning or removing crop residue often lead to declining agricultural productivity and increasing rural poverty (Shetto et al., 2007). About (78 %) of the farmers implement one or a combination of two principles.

The reason for the low level of adoption of SAPs in the study district could be as reported by Norman (2005) that most farmers have not been exposed to farming practice and support services that could promote uptake of the technology. Adoption levels and percentage of implementing households in Kilosa district are as presented in Figure 5.
Adoption intensity of sustainable agriculture practices

The adoption intensity of the SAPs differs significantly as the proportionate area used for the adoption was very small compared to
the area used by non-adopters, this is due to the poor climate conditions, limited land for the production and poor policies to facilitate
and encourage the adoption of sustainable agriculture practices in the study area. Thus farmers were left with no option other than
adopting the most profitable practices available so as to compensate for the cost incurred during the whole period of production and
for the welfare gain.

Profitability analysis for Adopters and Non-adopters

Table 8: Profitability analysis for Adopters and Non-adopters

<table>
<thead>
<tr>
<th></th>
<th>Maize Value</th>
<th>Costs incurred</th>
<th>Net profit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tshs/Ha</td>
<td>(Tshs)/Ha</td>
<td>(Tshs/ Ha)</td>
</tr>
<tr>
<td>Adopters</td>
<td>11.98</td>
<td>88.02</td>
<td>11.98</td>
</tr>
<tr>
<td>Non-adopters</td>
<td>22</td>
<td>39</td>
<td>11</td>
</tr>
</tbody>
</table>

Figure 2: Adoption Level of SAPs package in Kilosa District

Figure 3: The adoption intensity of the SAP over the Land use
A total of 550 respondents were used to analyze the objective of determining the profitability margin for the adopters and non-adopters of SAPs in maize farming. The SAPs average yields recorded 1680 kg and 2640 kg per Hectare for the non-adopters and adopters of fully packaged SAPs, respectively, which was equivalent to 14 and 22 bags of 120 kg, respectively as shown in Figure 1. The result showed that adopters were better off in terms of yield and revenue as compared to the non-adopters of SAPs in Kilosa District as shown in Table 2.

The results indicated that once SAPs is applied along with other supporting factors such as extension agents, nd inputs, it could have a significant effect on the household income, farm yield, and food security to the smallholder farmers who operated under subsistence or commercial farming.

However, despite not being widely adopted among smallholders, SAPs adopters seemed to operate on profit since the yield and revenue obtained from the farm activities were relatively higher compared to those of non-adopters.

Non-adopters of SAPs recorded less gross margin per hectare of 563 675 Tshs as compared to adopters 634 200 Tshs for the adopters as shown in Figure 2. The price of maize per kg during the season of year 2013/2014 was used to calculate the revenue against the costs that were incurred over the season. Nevertheless, the inadequacy of inputs and high prices attached to the inputs such as fertilizers and agrochemicals has contributed to the low adoption level of SAPs among smallholders maize farmers.

Previous studies on SAPs adaptation suggested that there is a positive correlation between SAPs and farm yield which implies that farm yields increase when SAPs is applied (Mazvimavi, 2011), the observations are is in line with the findings of this study. The possible explanation for the higher net benefits for adopter farmers could be that the smallholder's maize' farmers had fully embraced the SAP practices, and soils had regained their fertility.

The t-test of the difference of mean was used to determine the extent of the difference in the net profit/ha of the adopters and non-adopters. The average net farm income for adopters was significant (p<0.05), which shows that there is a significant difference between the net profit of the adopters and non-adopters Table 9.
Non-Adopters  1.02715  0.01131  450

IV. CONCLUSION AND RECOMMENDATION
Adopters of SAPs recorded a relatively higher gross margin than their counterparts because of the practices employed to produce crops for the particular year. SAPs practices provided adopters with environmental and income benefits. Nonadopters had not received a relatively beneficial package due to the inaccessibility to the necessary inputs, extension services, especially in rural areas. Nevertheless, non-adopters farmers perceived the use of chemicals methods as one of the effective means to get the amount of expected and often leave other environmental disadvantages aside especially to the soil fertility which in long run may pose a threat to the production of crops in their farms.

The study concludes that adoption of sustainable agriculture practices should be fundamental for sustainable agriculture development. As they both significantly whether the upgrading of community livelihood.

The economic profit of all principles of SAPs to adopters is only a fraction of the factors that influence adoption of SAPs. Ignoring the inclusion of social and environmental benefits analysis might create a false picture about the benefits of SAP technology. Farmers’ emphasis on only economic benefits could lead to the choice of shorter-term benefit technologies that might have negative impacts in the long run. Inadequate consideration of the various benefits of interventions for the promotion of SAPs could affect perception and hence the choice of SAPs farming practices.

Adopters of SAPs were found to be better off in terms of profit and yield compared to partial/non-adopters suggesting that farmers should adopt all the three principles of SAPs if they are to reap all the benefits to their farms regarding the output and profit. They are also advised to pay attention to all necessary inputs required for the proper adoption of SAPs to their farms.

To make SAPs profitable among smallholders maize farmers, the government should intervene in the most important areas of production such as infrastructures, inputs. Extension services and try to make them accessible to the low income earners and smallholders farmers. The effect would help to facilitate the adoption process of SAPs among smallholders farmers and help them afford the necessary inputs for a successive adoption of SAPs. Moreover, the Government should encourage the formation of smallholders farmers groups, this would encourage them to learn from each other and have easy access to necessary inputs at affordable price.

Most of the farmers were not able to afford the necessary inputs for the adoption of SAPs due to the high prices attached to the farm inputs, the financial institutions should be established in rural areas and be of help to the smallholder's farmers by setting the interest rate low. This will allow farmers to purchase the required inputs for their farming activities.

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1 The Sustainable Intensification of Maize and Legume Systems for Food Security in Eastern and Southern Africa (SIMLESA) program.

DECLARATION OF INTEREST
The author of this paper declare no any conflict of interest with any part.

REFERENCE.


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ASSESSMENT OF THE LEVELS OF MYCOTOXINS IN VARIETIES OF CEREALS (*Oryza sativa*, *Zea mays*, *Pennisetum glaucum* and *Triticum aestivum*) OBTAINED FROM CALABAR MARKETS, CROSS RIVER STATE, NIGERIA


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ABSTRACT - This study assessed the levels of four major mycotoxins (ochratoxin A, zearalenone, fumonisin B1+B2 and aflatoxin B1) in a total of twenty (20) samples consisting of five (5) samples each of *Oryza sativa*, *Zea mays*, *Pennisetum glaucum* and *Triticum aestivum* that were randomly purchased from different markets in Calabar, Cross River State. The four different food items were subjected to the same analytical procedures for extraction with 100ml solvent mixture containing water/methanol (3:2) and 2g of sodium chloride. The extracts were cleaned-up using a solid phase extraction process to remove interferences while separation and detection of mycotoxins were carried out using high performance liquid chromatography coupled with a fluorescent detector. The results revealed a wide and positive significant (P<0.05) variations in the concentrations of the mycotoxins and were mainly dependent on the cereal type. Overall mean concentration of aflatoxin B1 (1.56 ± 0.14 μg/kg), ochratoxin A (0.49 ± 0.04 μg/kg), fumonisin B1+B2 (135.33 ± 3.78 μg/kg) and zearalenone (55.00 ± 0.51 μg/kg) irrespective of cereal type were recorded. An overall order of concentration in the cereals by aflatoxin B 1 was maize > millet > rice > wheat, while by ochratoxin A and fumonisin B1+B2 it was maize > rice > millet > wheat. Results indicated that the levels of aflatoxin B1, ochratoxin A, fumonisin B1 + B2 and zearalenone were within Nigerian and European permissible limits of 2μg/kg, 5μg/kg, 800μg/kg and 75μg/kg respectively. This study confirms low levels of mycotoxins contamination of cereals from Calabar markets and suggests that consumption of wheat is relatively safer in terms of mycotoxins concentrations when compared to rice, millet and maize.

Keywords - aflatoxins, ochratoxin A, mycotoxins, cereals, HPLC

1.0 INTRODUCTION

Mycotoxins are toxic, low molecular weight organic compounds which when breathe in, absorbed through the skin or eaten causes immune suppression, sickness or deaths in human beings. Mycotoxins are one group of toxins that are usually found to be present in some cereal grains (e.g. wheat, rice, maize, groundnut, millet etc.) either processed or fresh and these are produced by fungi which have been approximated to contaminate crops to about 25% worldwide.[1] Mycotoxins had attracted worldwide concern owing to the fact that the heavy economic losses connected and attributed with their impact on human beings, farm animals and trade revenues.[2][3] In developing countries like Ghana, Togo, Nigeria, India etc, the combination of humid atmospheric conditions and insufficient drying encourage rapid increase of mold growth which in turn causes intolerable levels of mycotoxins particularly. Presently, the most prominent and economic important ones are: ochratoxin A, aflatoxin B1, zearalenone, fumonisins B, deoxynivalenol and patulin.[4] Reported studies have shown large-scale mycotoxin poisoning in both developing and developed countries with the presence of these mycotoxins in our cereals which is believed to be carcinogenic, nephrotoxic, teratogenic, immunosuppressive and mutagenic to man.[5][6][7] The aim of this study was to assess the prevailing levels of these four mycotoxins in the cereals obtained from different markets in Calabar, Cross River State and to know which of the cereal grains e.g millet, rice, wheat and maize preference should be given for consumption in situations where diet control is required.

2.0 MATERIALS AND METHODS

2.1 Samples and Sampling

A total of 20 samples were randomly purchased from (Mbukpa Marian, Ikot-Ishie and Bogobiri) markets in Calabar. Samples consisted of local rice (*Oryza sativa*), maize (*Zea mays*), wheat (*Triticum aestivum*) and millet (*Pennisetum glaucum*) grain. Stratified random sampling was carried out and later quartered to obtain 500g representative samples of laboratory size.[3] Samples were packaged in sealed plastic bags, labelled and taken to the laboratory where they were blended.
and detection for determination of ochratoxin A, zearalenone, fumonisin B1 + B2 and aflatoxin B1 mycotoxins.

2.2.1 Extraction and clean-up of mycotoxins

Milled samples (50g) were weighed into a 250ml conical flask and 100 ml solvent mixture containing water/methanol (3:2) and sodium chloride (2g) were added. This was shaken for 30 minutes to homogenise then centrifuged for 15 minutes to separate the liquid from solid. The same method of clean-up via solid phase extraction (SPE) was implemented for all the food products.[9] Elute from the column was allowed to dry and stored in glass vials before HPLC analysis.

2.2.2 Separation and Detection

This was carried out with HPLC Flexar FX-10 System (PerkinElmer, USA), Flexar autosampler tray, FL Flexar detector, KobraCell (100µA), Brownlee Pinnacle DB C18 reverse phase analytical column (50mm x 2.1mm, 1.9µm). It involves the use of high pressure (~6000 psi) to force the analyte (extract) in solution at a flow rate of 0.7 ml/min with an injection volume of 2µL. The solvents: water, acetonitrile and methanol used as the mobile phase of the HPLC and for re-dissolution of the extracts prior to HPLC were filtered through 0.45µm “Whatman” filter paper on a vacuum pump apparatus prior to attachment to the solvent inlet valves of the solvents before introduction into the pump to abate contamination by particulate matter that could result in column fronting or tailing.[10] The analysis of different mycotoxins involved the use of specific wavelengths. [11,12]

2.2.3 Data Analysis

Data obtained from the determinations were subjected to descriptive statistical analysis using Analyse-it® (version 3.0) statistical software for Microsoft Office. Inferential statistics for correlation were considered significant at 95% confidence interval (i.e. P<0.05).

3.0 RESULTS

All four mycotoxins of interest; aflatoxin B1, ochratoxin A, fumonisin B1+B2 and zearalenone were found present and the concentration of each is presented in Table 1-4 and Figure 1.

Table 1: Concentrations of mycotoxins in rice grain samples

<table>
<thead>
<tr>
<th>Mycotoxins</th>
<th>Concentration range (µg/kg)</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aflatoxin B1</td>
<td>1.40 – 1.49</td>
<td>1.41</td>
<td>0.03</td>
</tr>
<tr>
<td>Ochratoxin A</td>
<td>0.51 – 0.53</td>
<td>0.52</td>
<td>0.01</td>
</tr>
<tr>
<td>Fumonisin B1+B2</td>
<td>138.69 – 138.76</td>
<td>138.72</td>
<td>0.03</td>
</tr>
<tr>
<td>Zearalenone</td>
<td>54.24 – 54.27</td>
<td>54.25</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 2: Concentrations of mycotoxins in millet grain samples

<table>
<thead>
<tr>
<th>Mycotoxins</th>
<th>Concentration range (µg/kg)</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aflatoxin B1</td>
<td>1.60 – 1.63</td>
<td>1.60</td>
<td>0.01</td>
</tr>
<tr>
<td>Ochratoxin A</td>
<td>0.45 – 0.49</td>
<td>0.47</td>
<td>0.02</td>
</tr>
<tr>
<td>Fumonisin B1+B2</td>
<td>131.98 – 132.05</td>
<td>132.02</td>
<td>0.02</td>
</tr>
<tr>
<td>Zearalenone</td>
<td>55.52 – 55.60</td>
<td>55.55</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Table 3: Concentrations of mycotoxins in maize grain samples

<table>
<thead>
<tr>
<th>Mycotoxins</th>
<th>Concentration range (µg/kg)</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aflatoxin B1</td>
<td>1.73 – 1.78</td>
<td>1.76</td>
<td>0.02</td>
</tr>
<tr>
<td>Ochratoxin A</td>
<td>0.50 – 0.54</td>
<td>0.52</td>
<td>0.02</td>
</tr>
<tr>
<td>Fumonisin B1+B2</td>
<td>139.45 – 139.47</td>
<td>139.46</td>
<td>0.01</td>
</tr>
<tr>
<td>Zearalenone</td>
<td>54.79 – 54.84</td>
<td>54.81</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 4: Concentrations of mycotoxins in wheat grain samples

<table>
<thead>
<tr>
<th>Mycotoxins</th>
<th>Concentration range (µg/kg)</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mycotoxin</td>
<td>Concentration Range (mg/kg)</td>
<td>Mean Concentration (mg/kg)</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------</td>
<td>---------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Aflatoxin B₁</td>
<td>1.40 – 1.42</td>
<td>1.41</td>
<td>0.01</td>
</tr>
<tr>
<td>Ochratoxin A</td>
<td>0.42 – 0.44</td>
<td>0.43</td>
<td>0.01</td>
</tr>
<tr>
<td>Fumonisin B₁+B₂</td>
<td>131.10 – 131.12</td>
<td>131.12</td>
<td>0.01</td>
</tr>
<tr>
<td>Zearalenone</td>
<td>55.39 – 55.42</td>
<td>55.41</td>
<td>0.02</td>
</tr>
</tbody>
</table>

4.0 DISCUSSION

Ezekiel et al. (2012) [13] reported aflatoxin B₁ concentration range of 0.08 – 1.4 μg/kg in millet samples analysed which is lower than the concentration range of 1.60 – 1.63 μg/kg in millet in this study but was below the Nigerian and European Union permissible limit of 2 μg/kg for aflatoxin B₁ in this staple cereal; it is however relatively safe. Roasted groundnuts, raw groundnuts obtained from farm lands and raw groundnuts in storage locations were analysed for aflatoxin B₁ by (Ifeji et al. 2014) [14] and was reported to contain 64.78 ± 5.11 μg/kg, 54.32 ± 4.36 μg/kg and 42.78 ± 4.27 μg/kg respectively. This very high concentration in the groundnut samples required an urgent need for constant monitoring because it is one of the major staple foods in the country. Dimitrokallis et al. (2008) [15] reported that control cultures that were positive with only aflatoxin B₁ had a concentration of 197.20 ng/kg reduced to 82.52 ng/kg after incubating with 60 ng/kg of ochratoxin A for 14 days. This was attributed to the inhibitory effect of ochratoxin A to the production of aflatoxins and also divergent uptake behaviours of mycotoxins which indicates the transport of aflatoxins being different from that of ochratoxin A in samples as a result of physico-chemical effects. Data obtained from this study for aflatoxin B₁ (1.40 – 1.78 μg/kg) and ochratoxin A (0.42 – 0.54 μg/kg) are in agreement with this report of having a lower concentration of aflatoxin B₁ because of the presence of ochratoxin A.

The mean concentration of total aflatoxins (B₁+B₂) and ochratoxin A in rice samples obtained from the farm lands, store and markets in Niger State as reported by (Makun et al., 2007) [16] was 372 μg/kg and 200 - 1000 μg/kg respectively while the respective concentration values of zearalenone, deoxynivalenol and fumonisin B₁+B₂ in the study was not stated, it was reported to be relatively low. However, the rice samples were unsafe for human consumption and a cause for concern because of the high level of ochratoxin A and aflatoxins concentrations which exceeded the Nigerian and European Union permissible limit of 5 μg/kg and 4 μg/kg respectively. High level of aflatoxins could interact with other carcinogens like the hepatitis B virus and have a synergistic adverse effect thereby causing the prevalent liver cancer noticeable in Nigeria. [17] Also, the high concentration of ochratoxin A in the study was far above the Nigerian and European Union permissible limit of 5 μg/kg in maize and rice grown in Niger state can also promote the occurrence of renal diseases when people suffering from diabetes, hypertension and malaria consume these contaminated cereals as the case is in Nigeria. [17]

Furthermore, persistent intake of aflatoxins can increase the likelihood of premature delivery, childhood mortality, immunosuppression with vulnerability to other...
abnormality such as: stunted growth, infectious diseases like pneumonia.\(^{[18]}\) For example, in the year 2004 the consumption of aflatoxin infected food with concentration between 1,600 - 12,000μg/kg was implicated in the poisoning that lead to the death of hundreds in Kenya.\(^{[19]}\) In this study maize had aflatoxin B\(_1\) and ochratoxin A concentration of 1.73 – 1.78μg/kg and 0.50 - 0.54μg/kg respectively while rice samples had aflatoxin B\(_1\) concentration of 1.40 – 1.49μg/kg and ochratoxin A concentration of 0.51 - 0.53μg/kg which were below the Nigerian and European union permissible limit of 5μg/kg hence, the cereal analysed do not pose any health danger with respect to aflatoxin B\(_1\) and ochratoxin A.

Ayejuyo et al. (2008)\(^{[20]}\) reported an mean concentration of 0.34μg/kg of ochratoxin A in twenty different brands of imported rice sold in Lagos market while (Gwary et al. 2008)\(^{[21]}\) reported an overall mean concentration of 0.12 ± 0.07μg/kg in maize, millet and guinea corn obtained from Niger State. However, the mean concentration of ochratoxin A in this study: 0.43 ± 0.01μg/kg in wheat, 0.47 ± 0.02μg/kg in millet, 0.52 ± 0.01μg/kg in rice and 0.52 ± 0.02μg/kg in maize respectively were higher than the reports by (Ayejuyo et al. 2008; Gwary et al. 2008)\(^{[20,21]}\) but they were all below the Nigerian and European union permissible limit of 5μg/kg hence do not pose any health challenge.  The results of this study agreed with reports of (Makun, et al., 2007; Reddy et al., 2008)\(^{[16,24]}\) and rice samples grown in Niger state, Nigeria (Makun, et al., 2007)\(^{[16]}\) which confirms co-contamination with more than 5 different mycotoxins. The 4 major mycotoxins: aflatoxin B\(_1\), zearalenone, fumonisins and ochratoxin A assessed and found to be present in all rice, wheat, maize and millet samples in this study agrees with reports of (Makun, et al., 2007; Reddy et al., 2008)\(^{[16,24]}\) on the co-contamination of food products by more than one mycotoxin.

In this study, an overall correlation analysis was carried out to determine the co-contamination of mycotoxins in all four cereal types sampled. Table 5 contains varying r-values in the cereals analysed at a significant level of P < 0.05.

<table>
<thead>
<tr>
<th>Cereal pair</th>
<th>Aflatoxin B(_1) (r-value)</th>
<th>Ochratoxin A (r-value)</th>
<th>Zearalenone (r-value)</th>
<th>Fumonisin B(_1)+B(_2) (r-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Millet and Rice</td>
<td>0.22</td>
<td>0.17</td>
<td>0.27</td>
<td>0.40</td>
</tr>
<tr>
<td>Rice and Maize</td>
<td>0.00</td>
<td>0.00</td>
<td>0.29</td>
<td>0.35</td>
</tr>
</tbody>
</table>

People living with diabetes are advised to abstain from consuming food such as rice, garri, yam etc which are high in carbohydrate and replace with unripe plantain, wheat flour, etc which are rich in fiber, iron and with less composition of carbohydrate. With that in mind, Pearson's correlation coefficient was used to determine the relationship of individual mycotoxin between two different cereal grains analysed so the results can be used as a guide to advise affected individuals suffering from oesophageal cancer, breast cancer, liver cancer, kidney disease and hyper estrogenic effects. Also, these suggestions will act as preventive measures for healthy persons. Table 6 is the summary of correlation analysis between cereal pair for the four mycotoxins analysed from which aflatoxin B\(_1\) had a positive significant value of r = 0.75 between maize and wheat which implies that the more these cereals are consumed, the more one is prone to this hepatotoxin which causes liver diseases. It is however safe to suggest that wheat is a better alternative to maize for people suffering from liver diseases like cancer because it has a lower concentration of the aflatoxin when compared to maize. Table 6 showed a positive significant value of r=0.8 between wheat and rice, maize, and millet respectively for fumonisin mycotoxin which implies that the more these cereals are consumed, the more one is prone to this mycotoxin which causes oesophageal cancer.

Table 6: Summary of correlation analysis between cereal pair for the mycotoxins analysed

Table: Correlation matrices of mycotoxins in the four cereal samples

<table>
<thead>
<tr>
<th></th>
<th>Aflatoxin B(_1)</th>
<th>Ochratoxin A</th>
<th>Zearalenone</th>
<th>Fumonisin B(_1)+B(_2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aflatoxin B(_1)</td>
<td>-</td>
<td>0.329</td>
<td>-0.084</td>
<td>0.189</td>
</tr>
<tr>
<td>Ochratoxin A</td>
<td>0.329</td>
<td>-</td>
<td>0.628</td>
<td>0.808</td>
</tr>
<tr>
<td>Zearalenone</td>
<td>-0.084</td>
<td>0.628</td>
<td>-</td>
<td>0.940</td>
</tr>
<tr>
<td>Fumonisin B(_1)+B(_2)</td>
<td>0.189</td>
<td>0.808</td>
<td>0.940</td>
<td>-</td>
</tr>
</tbody>
</table>

Number of samples = 20
Also, from the result in this study, the maximum fumonisin concentration in rice, millet, maize and wheat are 138.76 μg/kg, 132.05 μg/kg, 139.48 μg/kg and 131.13 μg/kg respectively so an order of decreasing concentration can be suggested for preferential consumption (i.e wheat > millet > rice > maize) to reduce the potential risk of oesophageal cancer caused by fumonisin contamination since the richer the cereal is in carbohydrate, the higher the potential for mycotoxin production and contamination. However, wheat has less carbohydrate level than maize which suggests consumption preference for wheat with a lower fumonisin concentration value of 131.13μg/kg.

There is limited information on contamination and effect of production processes on fumonisin although in the Republic of Benin, Fandohan et al. (2005) reported a mean concentration of 1.99 ± 0.06μg/g in raw maize and a 80% reduction in the fumonisin concentration of the sample to 0.37 ± 0.06μg/g after separation by handpicking and up to 75% reduction in concentration to 0.54 ± 0.03μg/g after washing and fermentation of the raw maize sample. Martins et al. (2001) reported high level of fumonisin B₁ in orange leaves (350 – 700μg/kg), black tea (80 - 280μg/kg), leaves and flowers of linden tree (20 - 200μg/kg) with lower levels in corn silk (50 – 150μg/kg) and chamomile (20 – 70μg/kg). The fumonisin B₁ + B₂ concentration in this study (131.10 – 139.48μg/kg) falls within the range of 0.01 – 364μg/kg in other studies[26][27][28][29][30] on fumonisin contamination although less pronounced than levels detected in some of the cited studies. The cereals analysed for in this study do not pose any health challenge because high level of fumonisins in other value of 131.13μg/kg.

The concentrations of zearalenone in the cereals analysed in this study, the maximum mycotoxin contamination in the four cereals analysed suggest that consumption of wheat is relatively safer than maize, millet and rice. More research should be conducted on other food products as well as the health implications with relation to dietary exposure of people in Nigeria with organisations and governmental bodies playing key roles in this regard, collaboration in research involving multidisciplinary teams is needed for effective research, documentation, monitoring and evaluation of mycotoxins in Nigeria.

### 5.0 CONCLUSION

The low levels of mycotoxins contamination in the four cereals analysed suggest that consumption of wheat is relatively safer than maize, millet and rice. More research should be conducted on other food products as well as the health implications with relation to dietary exposure of people in Nigeria with organisations and governmental bodies playing key roles in this regard, collaboration in research involving multidisciplinary teams is needed for effective research, documentation, monitoring and evaluation of mycotoxins in Nigeria.

### References


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IDENTIFY THE SIGNIFICANCE OF PERFORMANCE APPRAISALS ON EMPLOYEE WORK IMPROVEMENT IN SOFTWARE DEVELOPMENT ORGANIZATIONS

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ABSTRACT

Majority of the organizations follow performance appraisal process to evaluate employee performance, and results of performance appraisals are used for a number of purposes such as administrative uses, rewarding, and identifying training needs. Most of the IT professionals perceive performance appraisal as an extra burden, and many questions about the appraisal process and results. IT professionals sometimes believe that performance appraisals have a negative impact on their motivation and work improvement. Therefore, it is imperative to study and understand the true impact of performance appraisals on employee work improvement in software development organizations.

This research attempts to identify the significance of performance appraisals on employee work improvement in software development organizations. The data were collected via an online survey from software engineers working in IT organizations in Sri Lanka. The study analyzed goal setting, self-evaluation, appraisal interview, employee participation for the process, pay for performance, and personal development as independent variables and satisfaction towards the process as mediating variable. It was found that the goal setting in the appraisal process, appraisal interviews, and personal development opportunities and pay for performance have moderate relationship with performance improvement. Meanwhile, Self-evaluation facility in appraisal process and employee participation for the process have weak positive relationship with performance improvement. On the other hand, Satisfaction for appraisal interview and rewarding mechanism act as moderating mediators for performance. It was also identified that for employees who had more than five years of experience, relationship between performance appraisal and work improvement was not significant. These findings can be incorporated to enhance and develop better performance appraisal processes in IT organizations.

Key Words: Performance appraisal, employee performance, work improvement

1 Background of the study

Performance appraisal is an important aspect in organizations because individual performance is the building block of organizational success and growth (Aguinis et al., 2013). A properly designed performance appraisal system is expected to provide valuable information to an employee about employees’ performance and progress at work (Gupta and Kumar, 2012). Human Resource Management (HRM) defines performance management as an integrated approach to ensure that an employee’s performance contributes to the organization’s strategic aims. Performance appraisal is a subset of performance management, and includes setting work standards, accessing performance, and providing feedback to motivate, correct, and continue their performance. It is also as a method to discover reasons for performance and the way to perform effectively in future so that employee, organization, and society gain benefits (Human Resource Management, 2010). The major benefits of performance appraisal are Linking organizational objectives with people behavior, Develop people through feedback and trainings, Share information upward, downward and sideways, Salary increments and compensation and reinforce the employees.

Employee performance appraisal results or outputs are quantitative and competencies are qualitative. The overall performance appraisal process includes the following phases (Human Resource Management, 2010):

- Planning performance – Performance objectives are planned and agreed at the beginning of the period.
- Enabling/managing performance – Formally/informally tracking performance during the year and give feedback.
- Reviewing performance – The process of thoroughly appraising the individuals’ performance at the end of the year. Identifying training needs, provide feedback and rewarding are the activities in this phase.

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**Motivation**

Software industry has proven its uniqueness in nature, operation, contribution to GDP, and human resource practices (Sanyal and Biswas, 2014). IT companies depend on their talented and skilled workforce. As a result, measurement and management of performance of individual, team and the organization is an essential practice (Sanyal and Biswas, 2014). However, performance management for knowledge workers is difficult because IT professionals are more perceptual than factual as their jobs are more complex (Guhanathan, 2007). Because IT organizations are dependent on skills and performance of its workforce, it is very important to measure employee performance for a given time period. Appraisal methods used in those companies are adopted from other industries such as manufacturing industry. So that it is important to study the impact of performance appraisal on employee work improvement in IT organizations. Study whether those organizations achieve the ultimate benefit of performance appraisal, and the relevance and effectiveness of performance appraisal methods used in those organizations. There are number of researches done in performance appraisal area but a small number of them address performance appraisal with relevant to IT industry. The central questions of this research is the significance of performance appraisal on employee work improvement in information technology organizations?

**Research Question**

Does the appraisal methods affect work improvement of software engineers?

**Research Objectives**

1. Determine the effect of performance appraisal on employee performance improvement in IT organizations.
2. Contribute to existing research resource pool in the field of performance appraisal in IT organizations and the impact on knowledge worker performance.

**Literature**

Performance appraisals are used in majority of the organizations. It allows an organization to measure and evaluate an employee’s behavior and achievements within a given period of time. Initially performance appraisal was used only for administrative purposes. In this era management and trade unions did not take appraisal as serious. In global rates, ratings were consisted with outstanding, satisfactory, and need improvement. In global essay evaluation method, performance related questions were asked. But these methods were not useful as expected because of their extreme subjectivity. Legal considerations on performance appraisal were established in 1960s. 1970 Equal employment opportunity commission guidelines and Civil Rights Act of 1964 and 1966 pointed out the need for improvements in performance appraisal methods. The purpose of performance appraisal process became employee development and feedback. Employees were motivated to seek feedback. There was also evidence that performance feedback can lead to improvements in future performance (Wiese and Buckley, 1998).

The evaluation of performance appraisal resulted with number of different performance appraisal methods. Performance appraisal methods are expected to serve multiple purposes simultaneously. It is important to clarify supervisor’s goals, employee’s goals and organizational goals (Dobbins, 1994). In late 1990s performance appraisal serves multiple objectives. Because of the changing definitions of jobs and roles in the organization the appraisal criteria should be changed. Researchers are focusing on reducing errors involving in the area of performance appraisal (Boswell and Boudreau, 1997).

Information Technology industry adopted performance appraisal in 1980s from manufacturing industry and adjusted it to fulfill requirements of that industry. Research with specific focus on performance appraisal and employee work improvement in IT organizations are limited (Wiese and Buckley, 1998).

**Definition of Job Performance**

Harvard University has published a competence dictionary and it has aligned competencies with performance. Competencies are “the things” that an individual must demonstrate to be effective in a job, role, function, task, or duty. These activities include job-relevant behavior (what a person does that results in positive or negative performance), motivation (how a person feels about a job, organization, or geographic location), and technical knowledge or skills (what an employee knows or demonstrates regarding facts, technologies, a profession, procedures, a job, an organization, etc.).

**Attributes of Performance Appraisal Methods**

Appraisal is one of the most complex and important Human Resource Management (HRM) activities. Employee participation for performance appraisal system is a very important component for fair and ethical evaluation of performance appraisal. Employees accept the appraisal results, if they perceive fair decision making process. Amount and quality of informal feedback, goal setting, performance standards, self-appraisal process, and interview style are the factors which affects employee participation of the system (Roberts, 2003). Research demonstrates that higher level of employee participation affects employee and rater acceptance and it leads to system satisfaction, motivation and productivity. The major concern is to develop standards to measure job duties and responsibilities. It is important to gather employee input in managing and performance scale creating. Self-appraisal provides
an opportunity to an employee to systematically evaluate his/her performance. Self-appraisal increases the level of employee participation and readiness for the process enhance satisfaction, perceived fairness and reduce defensive behavior. Roberts, (2003) focused on the impact of appraisal interview participation and its outcome towards satisfaction about the appraisal process. A quality performance appraisal interview includes preservation of confidentiality and privacy of employees. Focus on employee training needs promotional opportunities and skill development is major attributes that employees expect from entire process. Goal setting is a well-established factor for motivation. It is a proven theory that goal setting is clearly associated with satisfaction and performance. Effective feedback on performance is important, it should be timely and specific to the role. It leads employees to adjust their work performance.

3.1 Research Framework

Conceptual/research framework is an integration of researcher’s logical assumptions and published research findings. This considers boundaries and constraints which dominate the situation, and capture the interrelationships between variables. Figure 3.1 illustrates the research framework for this research. Each of the variables and their relationships are discussed next. Hypothesis were developed to check relationships between dependent and independent variables.

Figure 3.1 Conceptual framework.

**Hypothesis 01**

H1A: There is a positive relationship between effective goal setting in the appraisal system and employee performance.

H10: Effective goal setting in the appraisal system has no impact on employee performance.

**Hypothesis 02**

H2A: There is a positive relationship between self-evaluation criteria in appraisal system and employee performance.

H20: A self-evaluation criterion in appraisal system has no impact on employee performance.

3.2 Questionnaire Instrument Development

Table 3.4 presents the mapping between independent variables and questionnaire items. Table 3.5 presents dependent variables and questionnaire item count while Table 3.6 refers mediator variable and questionnaire item count. Independent variables and questionnaire item mapping is listed in Table 3.7. Table 3.8 refers to dependent variable and questionnaire item mapping and Table 3.9 shows the mediator variable and questionnaire item mapping. Table 3.10 show the demographic questions mapping.

**Method of Data Collection**

The “target population for the study is software engineers working in IT organizations.” Because the population is large and aim is to analyze the impact of performance appraisal on employee work improvement, most appropriate approach is quantitative methods. Present study is conducted for “selected sample of software engineers”. “Questionnaires are the most suitable method for data collection”. Face to face interviews are not a suitable method to study the impact of performance appraisal on employee work improvement in IT organizations because performance appraisal results are confidential and employees might not give an honest answer. Previous work in this area were also used questionnaires and responds were anonymous. Informal discussions were conducted to identify suitable variables and to get an idea about widely used performance appraisal methods in Sri Lankan IT organizations.

**Reliability Test**

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Before conducting the survey for a large sample it is important to check the reliability of the questionnaire instrument. Main objective of this step was to check the understandability of questions and internal consistency for the variables. In reliability study it is suggested to check whether the questions asked under each area supported each other.

**Descriptive Analysis**

The population of interest include software engineers working in software developing organizations and organizations which are having small development teams. The other requirement in selecting companies was that the companies need to practice a performance appraisal process. The survey was conducted electronically using an online questionnaire. Facebook, LinkedIn, email, and phone call campaigns were conducted to reach the sample. While the calculated sample size was 376, the researcher was able to collect only 255 responses due to low response. From those 255 samples, only 223 responses were considered as valid. Questionnaire was sent to approximately 800 software professionals. However, only 255 were returned. Hence, the effective response rate is 27.9%. It can be seen that 80% of responders belong to the software engineer and senior software engineer category. 8% were quality assurance engineers and 3% were tech leads. Rest includes project managers, system administrators, web developers, associate software engineers, business application consultants, business analysts, and technical writers. Because the research focus was on software/web/mobile application developers, responses from quality assurance engineers, system administrators, business analysts technical writers, and IT officers were eliminated. After this valid 223 survey responses were considered for further processing.

**Reliability Test for Sample**

In the research survey there were 42 items, 6 independent variables, one moderating variable and one dependent variable. Table 4.3, 4.4. and 4.5 list Cronbach’s Alpha Coefficients for independent, moderating, and dependent variables, respectively.

**Pearson’s Correlation Analysis**

Statistics generated with Pearson Correlation Matrix, is used to test the Hypothesis. Analysis based on demography also carried out for level of industry experience, number of appraisal cycles, age and type of organization. As illustrated in Table 4.7, goal setting in appraisal process and employee performance improvement has a low inter-relationship. Therefore, null hypothesis (H10) is rejected and alternate hypothesis (H1A) is substantiated. Hence, there is a positive relationship between effective goal setting in the appraisal system and employee performance.

**Table 4.7 Pearson’s correlation for hypothesis 1.**

<table>
<thead>
<tr>
<th></th>
<th>Goal_Setting</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal_Setting</td>
<td>Pearson Correlation</td>
<td>.487**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>N 223</td>
</tr>
<tr>
<td>Performance</td>
<td>Pearson Correlation</td>
<td>.487**</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td>N .000</td>
</tr>
</tbody>
</table>

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

4.4 Discussion on Results

According to research findings, performance appraisals and software engineers’ work improvement in IT organizations has a moderate relationship. According to Pearson’s correlations calculated for each variable, goal setting in the appraisal process, appraisal interviews, personal development opportunities and pay for performance had weak relationship with performance improvement. Self-evaluation facility in appraisal process, employee participation for the process had no positive relationships with performance improvement in software engineers. Satisfaction for appraisal interview and rewarding mechanism acted as a moderate mediator for performance.

Analysis was done for level of industry experience as well. Self-evaluation, participation for the appraisal process, appraisal interview, and pay for performance, personal development opportunities and satisfaction did not show any significance relationship with performance improvement in the category that has more than five years of industry experience. Goal setting, appraisal interview, pay for performance, personal development opportunities indicated moderate correlation with performance improvement in the category of employees who have three to five years of industry experience. For that category satisfaction
towards appraisal interview and rewarding acted as a moderate mediator factor for performance. Self-evaluation and participation for appraisal process showed weak relationships with performance in the groups of employees who have three to five years of experience and two years of experience, there was no impact in the group of who have less than two years of experience. Goal setting showed a strong relationship with performance improvement in the group of two years of experience.

Pearson’s correlation analysis done for type of the organization showed similar results. Goal setting, self-evaluation, participation for the appraisal process, appraisal interview, pay for performance and personal development opportunities showed moderate correlation to performance improvement in all three groups. Satisfaction acted as a moderate mediator factor for performance improvement in this analysis.

Related work in other industries have shown strong relationships in goal setting, self-evaluation, participation for the appraisal process, appraisal interview, pay for performance with respective to performance improvement. The impact of those factors was differing to software developing field. As cited in literature review software engineering field has its unique features and software engineers are knowledge workers. So the impact of performance appraisals on employee work improvement in that field indicated different results and it can be expected. A research by Guhanathan (2008) in this area considering software professionals, concluded that the appraisal methods used by Sri Lankan IT organizations are consist with three major components, employee participation in the process, goal setting and feedback. Moreover, it concluded that acceptance for appraisal process leads to satisfaction and satisfaction leads to more favorable outcomes such as performance enhancement and motivation. Present study was conducted with the consideration of major components in performance appraisal process and their impact to employee work improvement. Satisfaction with appraisal interview and rewards acted as a moderate mediator factor for performance improvement.

5.3 Conclusion for Future Work
Future research can be conducted by enhancing the method used to analyze the impact of performance appraisal on employee work improvement in IT organizations. It can be extended for various performance appraisal methods e.g., 360 degree performance appraisal, etc. If the researcher can access performance measuring tools and surveys which are used by Sri Lankan IT organizations, it will be more efficient to critically evaluate each process and identify the most effective method.

References


Insurance Services for borrowers of NGOs-MFIs; Is it helpful for them? Bangladesh perspective

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Abstract- Micro insurance is a subset of insurance that acts as social security and social safety net to the poor. Its clients and operational methodology are different from formal insurance companies. Non Government Organizations(NGOs)/Microfinance Institutions(MFIs) are developing new financial products and services to meet increasing client demand and micro insurance is one of the products that are gaining wide concentration in the world of micro finance. The micro insurance concept in Bangladesh has originated from the practice of microcredit programs of Grameen Bank and other NGOs/MFIs. In this paper we tried to see either micro-insurance services helpful or not. We found that micro0insurance is beneficial for its clients. Microinsurance is designed generally to address economic exclusion from resources, services, and/or social protection in the cases of death, ill-health, accident, and loss of property or other adversities of life. In fact, it is a kind of institutional risk mitigation service.

Index Terms- MFIs, Micro-insurance, NGO, Insurance coverage, borrowers

According to the ILO Convention 1952 (Convention No.102) on Social Security (Minimum Standard), nine branches of social security and the corresponding contingencies were covered: medical care, sickness benefit, unemployment benefit, old-age benefit, employment injury benefit, family benefit, maternity benefit, invalidity benefit and survivors’ benefit. The Convention No.102, added flexibility clause where it was mentioned that social insurance scheme that could provide minimum level of social security to the people of member states. From this perspective, insurance especially the micro insurance has been considered as a social security product and an additional financial tool to help people living with poverty coping with the risks and vulnerabilities they face in everyday life. Saving is the traditional way to cope with such risks whereas credit comes in with the objective to strengthen income-earning capacity or stabilize family incomes. Insurance extends the coping capacity to a next level of leverage as it increases the scope of risk coverage (Abels, 2005). It is true that not all micro insurance products play a role in extending social protection of the Poor. The products like property or asset, livestock, housing and loan protection insurance do not provide social protection. But on the other hand, some products like health, life, old age pensions and disability insurance policy addresses the nine contingencies specified in ILO’s Social Security Convention (No. 102) and therefore play a role in the extension of social protection (Churchill, 2006).

I. INTRODUCTION

Aggravated risk and vulnerability is a core element of daily life for poor people. Poor people must often struggle hard to bit by bit generate income and build their assets to get out of poverty. Microfinance makes this course smoother. For this reason micro finance is considered as verified strategy of poverty alleviation. But in the hazardous world of poverty, impulsive shocks such as illness, death within the family, especially primary household earners, and harm of assets affect the process of income and asset building. Sometimes micro finance itself is not sufficient enough to cope with these types of shocks. To cope with the shocks and vulnerabilities, poor people expect some financial as well as non financial services which can mitigate their shocks and vulnerabilities. The demand from the poorest for diversified financial and non-financial products as well as social security products like insurance is increasing day by day. Non Government Organizations(NGOs)/ Microfinance Institutions(MFIs) are developing new financial products and services to meet increasing client demand and micro insurance is one of the products that are gaining wide concentration in the world of micro finance.

II. OBJECTIVES

The objective of the present study is to evaluate the existing insurance services prevailing in the NGO-MFIs sector and how it influence in mitigating the risk of the borrowers.

III. INSURANCE AND MICRO INSURANCE

Insurance is a mechanism that uses risk pooling to compensate individuals and groups adversely affected by a specified risk or event (Cohen and Sebstad, 2003). Insurance can be defined as such a social and economic security product that pool risk, reduces vulnerability and provides more complete compensation. Micro insurance is a subset of insurance that provides social security and plays role of social safety net to the poor. Its clients and operational methodology are different from the existing formal insurance companies. The clients of micro insurance are
poor and they depend on low income. Usually this income flows fluctuate considerably throughout the year. The definition of ‘Micro insurance’ can be understood in two parts. First, the ‘micro’ portion of the definition refers to the subset of a product that is designed to be beneficial and affordable for low-income individuals or groups. Second, the ‘insurance’ component refers to a financial service that uses risk-pooling to provide compensation to individuals or groups that are adversely affected by a specified risk or event (Brown, 2000).

IV. EVOLUTION OF MICRO INSURANCE IN BANGLADESH

The micro insurance concept in Bangladesh has been originated from the practice of Microcredit programs of Grameen Bank and other NGOs/MFIs. The micro-insurance market of Bangladesh has been expanding over the last decade. But the products usually come from the supply side other than considering the demand and affordability of the clients. So far very little market research on micro-insurance has been conducted by the researchers, academics and practitioner organizations. Micro-insurance products offered by NGOs/MFIs and mainstream insurance companies are critically analyzed, very little product diversification and innovation will be observed. The NGOs/MFIs are offering mostly loan protection insurance. Some NGOs/MFIs are offering life, health, livestock and asset / property insurance. But the outreach of these products is very insignificant. Micro-insurance is an emerging sector, strongly linked to the microcredit movement in Bangladesh. In Bangladesh, micro-insurance is primarily provided by Non Governmental Organizations (NGOs) and Microfinance Institutes (MFIs). Most micro-insurance programs are linked to microloans, entrepreneur loans and are reliant on the group dynamics of microcredit. Micro-insurance is designed generally to address economic exclusion from resources, services, and/or social protection in the cases of death, ill-health, accident, and loss of property or other adversities of life. It is a kind of institutional risk mitigation service. Bangladesh has a long and outstanding history in the delivery and management of microcredit. Micro insurance or inclusive insurance service for the poor is a relatively new concept. NGOs-MFIs appeared in the micro insurance scene in the late 1990s and early 2000s with the exception of Gonoshasthio Kendro, which developed health micro insurance product in 1978. Grameen Bank and BRAC, as well as other MFIs/NGOs also provide health micro insurance. Most of the large NGOs-MFIs in Bangladesh offer a variety of micro insurance products to their clients. These MFIs/NGOs had several hundred thousand clients, strong information tracking capabilities through their large network of branches all over the country, and a stable saving and credit portfolio before they developed micro insurance product in their possession. Micro insurance products offered by MFIs/NGOs in Bangladesh cover the outstanding loan balance, health, disability and provide in some cases, an additional one-time monetary benefit to the client’s designated beneficiary. In Bangladesh to operate microcredit programs every NGOs-MFIs have to get license from a government organization. Here the public organization who gives license is Microcredit Regulatory Authority (MRA). It is a public statutory organization. MRA follows a Microcredit Regulatory Authority Act, 2006 and Microcredit Regulatory Authority Rules, 2010 to regulate microcredit activities operated by NGOs-MFIs. To date, MRA has given licenses to 758 NGOs4 MFIs to operate series of microcredit events. According to the Rules No. 25(1) and 25(2) of the Microcredit Regulatory Authority Rules, 2010, NGOs-MFIs can give insurance services to their members. Above discussion and evolution of micro insurance has indicated to the benefits of micro insurance. So, it has created a research question “Insurance Service for borrowers of NGOs-MFIs; Does it helpful for them?”

To verify this research question, insurance services by a number of NGOs-MFIs had been tested. Let the matter be cleared. Every year, licensed NGOs-MFIs cut a certain percentage of the total loan given to the members. The condition of cutting money as insurance is to excuse the borrower from paying loan and return his/her savings to his/her nominees. The table, mentioned below, depicts the end-balance of insurance for five consecutive financial years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount received</th>
<th>Amount expended</th>
<th>Ending balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2122519941</td>
<td>1355775357</td>
<td>6975462505</td>
</tr>
<tr>
<td>2011</td>
<td>2560911600</td>
<td>1912334899</td>
<td>8380817131</td>
</tr>
<tr>
<td>2012</td>
<td>2612435841</td>
<td>1857415217</td>
<td>9785019412</td>
</tr>
<tr>
<td>2013</td>
<td>2681973753</td>
<td>1990071514</td>
<td>12272278468</td>
</tr>
<tr>
<td>2014</td>
<td>1542984633</td>
<td>1028004314</td>
<td>7993195125</td>
</tr>
</tbody>
</table>

Source: MIS Section; Microcredit Regulatory Authority (MRA)
V. METHODOLOGY

The data were collected through analyzing of insurance policy of different NGOs-MFIs, field survey, discussion with different stakeholders. The licensed NGOs-MFIs of MRA were asked to give necessary information to test the consequences of micro-insurance services. Moreover, some data were collected from MIS section and website of Microcredit Regulatory Authority (MRA), newspapers. Based on the collecting data, we tried to analyze all kind of information. We explained cases one by one to reach the conclusion. Rules of micro-insurance services, how NGO-MFIs provide insurance services, coverage of micro-insurances-all are analyzed cautiously.

Literature review on micro insurance in Bangladesh:

Hasan (2008) and ILO (2003) studies on micro insurance found the following end results:

- The study found that 16 percent of 61 NGOs/MFIs offered life insurance.
- The dominating scheme is loan risk insurance - around 72 percent.
- Average premium per thousand was Tk. 8. Sum insured was the outstanding loan balance.
- Premium was set not by any scientific method but rather based on assumption.
- Micro insurance products and practices of some 24 institutions have been offering micro insurance schemes in Bangladesh.

<table>
<thead>
<tr>
<th>Types of insurance</th>
<th>Rates of interest/money charged(Insurance fee)</th>
<th>Services under Insurance Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td></td>
<td>Loan immunity after death;</td>
</tr>
<tr>
<td>Life</td>
<td>1%, or 0.5%</td>
<td>Some security benefit for nominee after death of member;</td>
</tr>
<tr>
<td>Loans/capital</td>
<td></td>
<td>Funeral/Cremation management;</td>
</tr>
<tr>
<td>Livestock Disaster</td>
<td>BDT 5.00 per thousand</td>
<td>Loan immunity for member’s husband/guardians;</td>
</tr>
<tr>
<td>Micro entrepreneur</td>
<td>1.5%</td>
<td>Medical services;</td>
</tr>
<tr>
<td>Seasonal</td>
<td>2.0%</td>
<td>All kinds of savings return to his/her nominee;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cash payment for loss of organ</td>
</tr>
</tbody>
</table>

Table: Micro insurance, rate of interest and services.

Does micro-insurance helpful for borrowers?

The case study analysis of micro-insurance services is conducted as a mechanism to address and verify the research question. To verify the research question, some cases were authenticated. It is found that as per the conditions of the micro-insurance services, NGOs-MFIs excuse borrowers from paying remaining loan balance if any borrower dies. They also pay back the savings to their selected nominees.
Box: Some case studies

The above mentioned case studies prove that micro-insurance policy of different MFIs is cooperative and beneficial for members of NGOs-MFIs institutes. Borrowers get much kind of supports from the MFIs under the coverage of micro-insurance policy. In the above mentioned box, we see that when borrower Khulni Shordar of Bangladesh Health and Education Development Society died, her loan balance was BDT 21,680 and savings was BDT 3750 at that time. As coverage of micro-insurance, she and her family members were exempted from loan and her nominee was paid back the savings. Another case study of Proyash Manobik Unnayan Society showed that when borrower Anjuara Bibi had died, her loan balance and savings were BDT 15,000 and 1586 respectively. She was freed to pay remaining loan and her deposit was paid to her nominee. Besides that, that MFI gave her family members BDT 5000 to bear the cost of funeral.

Micro-insurance is an emerging sector, strongly linked to the microcredit movement in Bangladesh. Since the case studies and documents, survey etc. recommends the benefits of micro-insurance; So Stakeholders are provided different kinds of assistance under the coverage of the micro-insurance schemes. They get redemption of paying loan, educational support, health services, medical treatment, and expense for funeral/cremation from the micro-insurance policy.

VI. CONCLUSION

It is worldwide recognized that Bangladesh has been considered as pioneer in microcredit with diversified products. Many NGOs/MFIs in Bangladesh are striving to offer demand driven and diversified financial products and services to the poor people. But still a significant number of poor people are vulnerable to adverse situation in their life cycle and untapped with social security products like insurance that can be a social safety net for them. This informative analysis on the helps of micro-insurance support that it can serve the interests of poor populations with risk-mitigation to manage unpredictable loss,
catastrophic events as well as it gives educational support, health service etc. There are more services can be made under micro insurance scheme. But during examining services of micro insurance, it is found that since death rate of borrowers is not high, so the charge, the NGOs-MFIs cut during paying loan, it aids to create huge capital fund for this organizations. As a consequence, it creates an important question like “How does remaining insurance fund can be utilized alternatively?”

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AUTHORS

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ASSESSMENT OF THE LEVELS OF PERSISTENT ORGANIC POLLUTANTS (POLYCHLORINATED BIPHENYLS) IN EFFLUENTS FROM PETROLEUM PRODUCTS TANK FARM IN CALABAR JETTY, CROSS RIVER STATE, NIGERIA

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ABSTRACT: This study has its objectives of assessing the levels of polychlorinated biphenyls in five soil samples collected from the effluent channel of petroleum product tank farm in Calabar Jetty, Cross River State. The five soil samples were subjected to analytical procedure by extracting with n-hexane/acetone mixture volume (1:1). The extracts were distilled at 56°C to remove acetone and the residue from each extract was mixed with 20ml of distilled water and separated with a separatory funnel. The hexane phase was collected from each sample and the clean-up process was carried out using florisil column prepared according to slurry packing technique (1cm x 25cm glass column containing 5.0g florisil, 60-100mesh, conditioning for 4hrs at 250°C) then deactivated with 5% water by weight, with a layer of anhydrous sodium sulphate on top to remove interferences before they were analyzed and quantified using GC-ECD/MS instrumentation. The results revealed presence of PCBs in all the samples except the control sample. The chromatograms identified some PCB congener numbers present in the samples and they are: PCB 18, PCB 33, PCB 44, PCB 48, PCB 122, PCB 145, PCB 150, and PCB 167. The results indicated the various concentrations of PCBs present and levels of PCBs were at toxic limits which could be detrimental to the environment and human health. Thus suggestions were made on the best way to dispose these effluents.

Keywords - Polychlorinated biphenyl, Congener, Effluents, Tank farm, Jetty.

1.0 INTRODUCTION

Polychlorinated biphenyls (PCBs) are compounds containing some chlorine atoms attached at different positions of the biphenyls molecule. Biphenyls molecule is a molecule made of two benzene compounds joined together by carbon to carbon single bond. These Polychlorinated biphenyls do not occur in nature, they are introduced into the environment by anthropogenic activities. PCBs have been sold out to different countries with many trade names such as: Aroclor, Chloretol, Clophen, Phenoclor, Fenclor, Kanechlor, Pyranol, Sovol etc.[1] PCBs are introduced into the environment through leakages from most electrical equipment containing capacitors, hydraulic oil, petroleum product effluents, transformers and liquid heat exchangers or coolants. The PCBs when given off goes into the air, water, sediment and soil. It was eventually banned in 1979 by United States Stockholm convention and was classified among the persistent organic pollutants in 2001.[2] Some electrical equipment at elevated temperature emits PCBs into the atmosphere which goes into the food chain thereby affecting the fishes and other aquatic organisms in the river. These fishes when consumed by man causes ailments such as birth defects.[3] They affect the hormone system in man especially the sperm count and causes cancer in animals.[4]

In the phase of all these, it is pertinent that these effluents from the petroleum tank farm in Calabar Jetty identified to be toxic should be properly treated using the most effective method of destruction to reduced its toxicity level before been discharged to the environment.

2.0 MATERIALS AND METHODS

2.1 Sample Collection

The soil samples were collected from the effluent channel of the company. The sampling was done using shovel, auger, and spade. The soil samples were collected at different depth ranging from (0.05 – 0.20m) depth. Five (5) samples were collected from company Hamdza.[3] The samples were poured into polythene sack bag and taken to the laboratory where pH, conductivity and temperature were taken before storage.

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2.2 Sample preparation
The samples were air dried for a period of two months and all foreign materials such as leaves, sticks and stones were removed in the process. The samples were then crushed with pestle and mortar, sieved to a fine powder using a sieve with aperture 100micron.

2.3 Extraction process
100g of each sample was weighed into a sample bottle and 100ml mixture of n-hexane: acetone, 1:1 (v/v) was added for batch extraction. The mixture was allowed to stay for 24hrs after which decantation was carried out. The liquid was filtered into a round bottom flask and was distilled to a temperature of 56°C to remove all acetone present. The residue was collected and poured into a separating funnel. 20ml of distilled water was poured into the separating funnel. The mixture was shaken thoroughly and allowed to settle in phases (Hexane/ Water phase). The hexane phase was collected in vial bottles for gas chromatography and mass spectrometry analyses. The procedure was repeated four times for the five samples.

2.4 Gas chromatography clean-up process
The samples were allowed to evaporate to dryness in air then dissolved in 1-2ml of hexane. The elution was done with 50ml n-hexane through florisil column prepared according to slurry packing technique (1cm x 25cm glass containing 5.0g florisil, 60-100mesh, conditioning for 4hrs at 250°C) then deactivated with 5% water by weight, with a layer of anhydrous sodium sulphate on top, and rinsed with 50ml n-hexane before use. The fraction obtained was then used for G-C analysis.[5]

2.5 GC – ECD/ MASS SPECTROMETRY (Hewlett Packard 6890).
The GC equipment with Ni electron capture detector (ECD) having DB – XLB fused silica capillary column(60m x 0.25m, 0.25um thickness) at 50KPa pressure was used. Helium gas of very high purity was used as the carrier gas at 54.4ml/min. Following the injection, the GC temperature was initially set at 60°C for 1min, then temperature was programmed to 140°C at 10°C/min, at 0.9°C/min to 220°C/min and at 5°C/min to 290°C (hold for 15mins). Identification of the PCB ion peaks were based on the retention time relative to the Internal Standard and their relative abundances of the ions monitored. The mass spectrometry connected to the GC gives the qualification by comparing the integrated ions current response of the target ions to those of the internal standard and their relative abundances of the ions monitored.

3.0 RESULTS
The five samples show variation in temperature, pH, conductivity and appearance as seen in Table 1, the samples except the control sample 5H have the presence of polychlorinated biphenyl compounds with various retention time and concentration as shown in Figures 1-5 and Tables 2-6.
Table 1: Physical properties of soil samples from company Hamdza

<table>
<thead>
<tr>
<th>S/No</th>
<th>Sample Name</th>
<th>Temperature (°C)</th>
<th>pH</th>
<th>Conductivity (µScm⁻¹)</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sample 1</td>
<td>27.9± 0.10</td>
<td>7.79± 0.05</td>
<td>1.10± 0.06</td>
<td>Black</td>
</tr>
<tr>
<td>2</td>
<td>Sample 2</td>
<td>27.2± 0.10</td>
<td>7.79± 0.03</td>
<td>0.25± 0.01</td>
<td>Black</td>
</tr>
<tr>
<td>3</td>
<td>Sample 3</td>
<td>27.7± 0.20</td>
<td>7.53± 0.03</td>
<td>1.46± 0.10</td>
<td>Black</td>
</tr>
<tr>
<td>4</td>
<td>Sample 4</td>
<td>27.3± 0.10</td>
<td>7.72± 0.01</td>
<td>0.92± 0.07</td>
<td>Black</td>
</tr>
<tr>
<td>5</td>
<td>Sample 5</td>
<td>27.9± 0.10</td>
<td>7.69± 0.02</td>
<td>2.26± 0.10</td>
<td>Brown</td>
</tr>
</tbody>
</table>

Table 2: GC-MS identified compounds in sample 2

<table>
<thead>
<tr>
<th>PCB</th>
<th>Retention time (mins)</th>
<th>Concentration (ppm)</th>
<th>IUPAC name and structure of compound Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>8.196</td>
<td>0.090± 0.002</td>
<td><img src="image" alt="Image of 2,2’,5 – trichlorobiphenyl" /></td>
</tr>
<tr>
<td>33</td>
<td>9.347</td>
<td>0.010± 0.001</td>
<td><img src="image" alt="Image of 2’,3,4 – trichlorobiphenyl" /></td>
</tr>
</tbody>
</table>
Table 3: GC-MS identified compounds in sample1\(^{11}\)

<table>
<thead>
<tr>
<th>PCB congener No.</th>
<th>Retention time (mins)</th>
<th>Concentration (ppm)</th>
<th>IUPAC name and structure of compound Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>8.156</td>
<td>0.06</td>
<td><img src="image" alt="2,2',5 – trichlorobiphenyl" /></td>
</tr>
<tr>
<td>33</td>
<td>9.352</td>
<td>0.05</td>
<td><img src="image" alt="2',3,4 – trichlorobiphenyl" /></td>
</tr>
<tr>
<td>48</td>
<td>10.291</td>
<td>0.13</td>
<td><img src="image" alt="2,2',4,5 – tetrachlorobiphenyl" /></td>
</tr>
<tr>
<td>44</td>
<td>11.035</td>
<td>0.03</td>
<td><img src="image" alt="2,2',3,5’ – tetrachlorobiphenyl" /></td>
</tr>
<tr>
<td>122</td>
<td>16.625</td>
<td>0.02</td>
<td><img src="image" alt="2,3,3',4',5’ – pentachlorobiphenyl" /></td>
</tr>
</tbody>
</table>

Table 4: GC-MS results in sample 5\(^{11}\)

<table>
<thead>
<tr>
<th>PCB congener No.</th>
<th>Retention time (mins)</th>
<th>Concentration (ppm)</th>
<th>IUPAC name and structure of compound identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

ND: Not Detected.

Table 5: GC-MS identified compounds in Sample 3\(^{11}\)
<table>
<thead>
<tr>
<th>PCB congener No.</th>
<th>Retention time (mins)</th>
<th>Concentration (ppm)</th>
<th>IUPAC name and structure of compound identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>8.180</td>
<td>0.610±0.002</td>
<td><img src="image" alt="2,2,5 – trichlorobiphenyl" /></td>
</tr>
<tr>
<td>33</td>
<td>9.393</td>
<td>0.120± 0.006</td>
<td><img src="image" alt="2’,3,4 – trichlorobiphenyl" /></td>
</tr>
<tr>
<td>48</td>
<td>10.268</td>
<td>0.100± 0.004</td>
<td><img src="image" alt="2,2’,4,5 – tetrachlorobiphenyl" /></td>
</tr>
<tr>
<td>44</td>
<td>11.018</td>
<td>0.300± 0.004</td>
<td><img src="image" alt="2,2’,3,5’ – tetrachlorobiphenyl" /></td>
</tr>
<tr>
<td>167</td>
<td>17.758</td>
<td>0.020± 0.001</td>
<td><img src="image" alt="2,3’,4,4’,5,5’ – hexachlorobiphenyl" /></td>
</tr>
<tr>
<td>150</td>
<td>19.063</td>
<td>0.020± 0.001</td>
<td><img src="image" alt="2,2’,3,4’,6,6’ – hexachlorobiphenyl" /></td>
</tr>
</tbody>
</table>

Table 6: GC-MS identified compounds in sample 4th
<table>
<thead>
<tr>
<th>No.</th>
<th>Cl Value</th>
<th>Temperature (°C)</th>
<th>EC Value (μS/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>8.179</td>
<td>27.2±0.10</td>
<td>0.32</td>
</tr>
<tr>
<td>33</td>
<td>9.318</td>
<td>27.9±0.10</td>
<td>0.21</td>
</tr>
<tr>
<td>48</td>
<td>10.251</td>
<td>27.55±0.10</td>
<td>0.12</td>
</tr>
<tr>
<td>44</td>
<td>11.046</td>
<td></td>
<td>0.23</td>
</tr>
<tr>
<td>145</td>
<td>16.425</td>
<td></td>
<td>0.02</td>
</tr>
<tr>
<td>167</td>
<td>17.695</td>
<td></td>
<td>0.03</td>
</tr>
<tr>
<td>150</td>
<td>18.977</td>
<td></td>
<td>0.03</td>
</tr>
</tbody>
</table>

**4.0 DISCUSSION**

The parameters in Table 1 show that the temperature of the five samples were between the range 27.2± 0.10°C to 27.9 ± 0.10°C with a mean temperature of 27.55 ± 0.10°C. These temperature values were relatively the same as the room temperature on the day of sampling. The pH values tend slightly to alkalinity and were between the range 7.53 ± 0.03 to 7.79 ± 0.05, this same range was reported by Moret\[^6\] in sediments from Porto Marghera area. The electrical conductivity of four samples were very low except for control sample 5 which has a high value of 2.96 ± 0.10μS/cm. These
low values in electrical conductivity validate one of the physical properties of PCBs having low electrical conductivity in nature. The dark colour observed may be as a result of the types of effluent discharge and also the presence of PCB, since the control sample was lighter in colour. GC-MS chromatogram in figure 1-figure 4 and table 2,3,5, and 6 results indicated the presence of PCB 18, PCB33, PCB 44, PCB 48, PCB 122, PCB 145, PCB 150 and PCB 167. In all the samples there were PCBs present except for sample 5. The chromatogram for the control sample in figure 5 and result in table 4 has no identified PCB peak present in the sample. The identified PCBs have ortho-substituted congeners which had been reported by Simon to cause neurotoxic and immunotoxic diseases while the di-ortho substituted congeners, PCB 145 and PCB 150 interfere with intracellular signal transduction, and also leads to neurotoxicity. It is also reported by Chauhan that ortho-substituted PCBs can disrupt the thyroid hormone movement by binding to transthyretin. Other symptoms of PCBs, such as birth defect in man and hormonal imbalance so as to eliminate some of these ailments associated with PCBs, such as birth defect in man and hormonal imbalance and cancer in animals. [1][2][3][4]

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An effective use of anodizing mud for treatment of tannery wastewater as a coagulation agent

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Abstract: Treatment of Tannery effluent is challenging task as it is a biogenic matter of hides and a large variety of organic and inorganic chemicals. The objective of this present work is to study the application of aluminum anodizing mud as coagulant for the treatment of tannery wastewater. The anodizing mud was tested in two different forms: as powder and as mud suspension. A series of coagulation / flocculation tests were made, with subsequent optimization of important parameters such as pH, coagulant dose, stirring conditions (time and speed) and settling time. The effective coagulant capacity of the anodizing sludge was verified based on the pollutant i.e. total solids 59.8%, total dissolved solids 53.6%, total suspended solids 87.4%, grease and oil 100%, sulphate 32.9%, sulfide 100%, chromium 99.1%, C.O.D 70% and B.O.D 66.5% on composite sample was removed of the supernatant sample as a function of the coagulant dose and pH and found very effective method.

Keywords: Anodizing waste; tannery wastewater; aluminum; flocculation; coagulation.

Introduction:
Tannery wastewater treatment is a significant ecological and environmental issue, mostly in the developing countries delivering the majority of global leather production for the past two decades (Iqbal et al., 1998). Beam house operation, tan-yard processes, re-tanning, and finishing are the stages of the tanning process that finishes leather; the process generates different kind and amount of wastewater depending on end products (K. Cooman, et al., 2003; G. Lofrano et al., 2013). Chemical oxygen demand (COD), suspended solids (SS), Cr, sulphide, oil and grease, total kjeldahl nitrogen (TKN), and pH ranges reported in the related literature to characterize wastewater from tannery industry varied greatly across and within the countries.

The use of aluminum in the clarification of water is common practice in wastewater treatment (Yu Zhou et al., 2008). When aluminum salts are dissolved in water, dissociation into the constituents occurs. These ions are submitted to hydration reactions. The products of the hydrolyze reactions of the aluminum salts are the effective coagulant agents (Pratheesh, 2014).

Anodizing is a process for producing decorative and protective films on articles made from aluminum and its alloys. It is essentially a process where a thick film of aluminum oxide is built up on the surface of the aluminum through the use of a direct current electrical supply through an acid electrolyte bath in which the aluminum is immersed (Juan et al., 2014).

Large quantities of waste (anodic mud) are generated in the manufacturing of refractory bodies, and the synthesis of useful minerals from the wastewaters arising from the etching, anodizing and brightening processes. In the industrial facilities there are normally two kinds of effluents clearly differentiated concentrated solutions, as well as washing waters. In most cases there are no treatments facilities in industries i.e recovery of caustic, sulphuric acid and the wastes are discharged directly in sewer or on land (Mihaela et al., 2014; Ankur Pyasi., 2014). This anodic sludge is a big problem for many countries because it is relatively difficult to manage due to its complex nature.

Anodizing mud, which has a variable composition but contains three main constituents: aluminum hydroxide, oxy-hydroxides and basic sulphate, mainly of aluminum. Testing of mud mentioned in Table-1.

At present time the common practice in the Aluminum industries is that, if concentration of aluminum increase in the anodizing bath i.e 20 to 25% and in etching bath 50 to 60% than the 70- 80 % of volume dispose of in direct sewer and huge quantity of mud formed and blockage of sewer line and the cost of open sewer line is high. Now a day this situation represents a really great environmental problem which must be resolved on urgent basis.

The use of aluminum mineral salts in wastewater treatment is much spread. "Coagulation-flocculation process could be considered as one of the most typical physicochemical processes used in water and wastewater treatments due to its easy operation, relatively simple design and low energy consumption (Teh and Wu, 2014; Feng-shan et al., 2015; Abd-el-Kader et al., 2014; Indrani et al., 2014; Eduardo et al., 2014; Varank et al., 2014; Om and Kumar, 2014; Chai Siah et al., 2014; Bartolomeu et al., 1996). Research on aluminum as a coagulant is since long. In the current work we have studied anodizing
sludge from one facility in the treatment of tannery wastewater instead of the conventional inorganic coagulants. In the same work anodizing sludge was selected due to its chemical composition of aluminum and two forms of the coagulants were tested: powder and mud suspension.

Coagulation is a well-known process associated with solid-liquid separation process. It is the removal of turbidity, color or micro-organisms that are present in the wastewater as colloidal suspensions (H. Effendi et al., 2015; N. Muralimohan et al., 2014; Sunita et al., 2014; Priyanka et al., 2014; Swathi et al., 2014; Edris et al., 2013; Brian and Charles, 1984). These suspensions are heterogeneous mixtures of particles with different size, shape and chemical composition. A colloid has been defined as a dispersion of distinguishable particles in the size range of 0.01-10 nm in a medium that may be regarded as a structure less continuum. Colloidal systems will usually scatter light, i.e. they exhibit turbidity, which is related to the sizes of the particles involved. Colloidal suspensions in aqueous media appear cloudy. The observed turbidity depends on both the particle size distribution and the mass concentration present. This type of particles tends to remain in suspension for a long period of time and due to its great stability colloids do not form aggregates (Er. Devendra et al., 2014; Edris et al., 2014; N.B.Prakash et al., 2014; T. Sugumaran et al., 2014).

The most important interactions affecting suspension stability are electrostatic repulsion and Van der Waals attraction. According to O’Melia (O’Melia C. 1972) four mechanisms of coagulation are recognized: compression of the diffuse layer, adsorption to produce charge neutralization, enmeshment in a precipitate and adsorption to permit inter particle bridging (B.Lekhlif et al., 2014). The destabilization of colloids in water and wastewater is probably accomplished by adsorption of oppositely charged soluble and insoluble coagulant hydrolysis species on the colloid and subsequent destabilization, enmeshment of colloid within hydroxide or carbonate precipitates or both (Muhammad et al., 2014; Asha et al., 2011).

Apart from using aluminum salts as a coagulant, several natural coagulants, such as rice husk, rice starch (Swathi et al., 2014; Teh et al., 2014a; Teh et al., 2014b), Cassia obtusifolia seed gum, Moringa Oleifera Seed (Aminu et al., 2014; Shak et al., 2014; Subramonian et al., 2014), mustard seed extract (Bodlund et al., 2014), Plantago major L (Chaibakhsh et al., 2014) and others, were attempted in wastewater treatment. Several hydrolysis species can be formed depending on the pH, temperature and the concentration of mineral salts (Raul et al., 2014; B.Lekhlif et al., 2014; Rasha, 2014; Bhaskar et al., 2014). These hydroxy-metal complexes adsorb on the particle surfaces and the charges they carry may cause charge reversals of the surfaces they adsorb on, contributing to the destabilization of the suspension. The hydrolysis reactions have a great tendency to release H⁺, lowering the pH. A different but important effect of the coagulation characteristics of aluminum is the formation in the alkaline range of a hydroxide precipitate that appears as a fine colloidal dispersion. These particles tend to aggregate, forming hydroxide floc and then enmesh the colloidal particles present in the wastewater will occur depends on the concentration of aluminum and pH, as observed by Gregory (Gregory, 1978). It can be seen i.e. acid range predominates the coagulation mechanism of adsorption and charge neutralize and in alkaline range it happens the mechanism of sweep floc with formation of a precipitate and drags the suspended particles.

Experimental

Apparatus

A model 3510 pH meter Genway with glass electrodes was used for the pH DR-4000, HACH Spectrophotometer was used.

Hot plate with stirrer (HS 10_2, Torry Pines Scientific, USA) was used for stirring.

Chemicals and reagents

All chemicals employed in this study were analytical grade. All solutions were prepared in distilled/de-ionized water made on each experimental day. Glassware used in this work was soaked with HNO₃ (~10%) for 24 h, and rinsed with distilled/de-ionized water prior to drying. Hydrogen per oxide used, was of analytical grade as 30% by wt.

Sampling

For the present investigation, the fresh mud was prepared and collected anodizing and etching solution from one industrial facility located at SITE Industrial Area Karachi.

Two different anodizing aluminum process baths were selected i.e. from etching and anodizing mixed in the ratio 1:1 which formed an anodizing mud. The etching wastewater is composed of caustic soda and aluminum whereas wastewater from anodizing consists of sulphuric acid and aluminum.

Analysis of physico-chemical parameters

All the pollutant parameters were analyzed following the procedure:

The pH value, total solids, total dissolved solids, total suspended solids, oil and grease, sulphates, sulfide, chromium, Chemical oxygen demand (COD) and Biological oxygen demand (BOD) before and after treatment of tannery effluent were determined according to Standard Methods for the Examination of water and wastewater 20th edition 1998.

In dry and suspension mud 1% solution was prepared and proceed to determine pH value, total sulphate%, total aluminum%, sodium%, calcium%, tin%, total chromium in mg/kg, chromium( VI) in mg/kg. the APHA methods were used respectively measured in HAACH DR-4000 spectrophotometer (HACH 1992).

Methodology

Chemical coagulation

For the preparation of anodizing mud (Fig. 1) selected from two different facilities having the operations of etching and anodizing aluminum bath, were well mixed and homogenized. The anodizing sludge was characterized and the results obtained are presented in the Table 1. It was observed that aluminum is one of the major constituents of the compositions of in the sludge along with the total sulphates.
When using the sludge as mud suspensions, water was added to the fresh mud in a way that the solids percentage was known. The total solids, in the mud suspension tested, was 19% of sludge.

In order to stabilize the anodizing sludge it was dried at room temperature for several days. The time needed for the stabilization process was dependent on particle / cake size, room temperature, air humidity and sludge moisture. Finally it was kept in an oven at 110°C for six hours till constant weight is achieved. Then the dried sludge was grinded and passed through a screen of 292 mm so that a homogeneous powder of constant characteristics in stabilized form was produced for the treatment of tannery wastewater experiments.

Coagulation and precipitation studies were performed in a six-place conventional jar-test apparatus, equipped with 6 beakers of 2000 ml volume. Before coagulation process (Fig. 2) tannery wastewater sample was thoroughly shaken to avoid possibility of settling solids. The experimental process consisted of the initial rapid mixing stage that took place for 10 min at 300 rpm, the following slow mixing stage for 45 min at 100 rpm and the final settling step for 2 h. After 2 hour settling period, samples were withdrawn from supernatant for analyses (Muhammad et al., 2014).

Results and Discussion:

A series of tests were programmed, being controlled important parameters such as coagulant dose, mixing and flocculation conditions (stirring time and speed and settling time). The coagulation process was effective for the tested mud and the two different forms, powder and mud suspension. The formations of flocs that settle rapidly were visible. The tests performed have demonstrated the efficiency of the anodizing mud as a coagulant being the optimal dose. The laboratory tests were performed using samples of 2000 ml of tannery wastewater in each experiment. The representative samples of tannery wastewater used in this study were collected from Korangi Industrial Area, Karachi at the entrance of treatment plant which recovers the tannery wastewater corresponding to 130 tanneries. The knowledge of the constituents of the tannery wastewaters is important for the quantification of the pollutants removal after the treatment. For this work, three different samples of tannery wastewater were collected in different time and dates. Relevant parameters of the tannery wastewaters were determined and prepare one composite sample presented in the Table 2. All parameters were tested in duplicates.

Coagulation / flocculation process consists in three steps: coagulation of the suspended solids, growing of the micro flocs and elimination of the floc aggregates formed as shown in (Fig. 3).

The degree of clarification obtained when chemical aids are used in tannery wastewater treatment depends on the chemicals quantity and in the control and monitoring of the process (G. Shebang. 2014; 2015). The use of aluminum salts in the treatment of wastewater is a common practice and the quantity added usually ranges between 0.05 and 0.3g/l. In this work the coagulant dose varies between 0.5 and 5.0 g/l, stirring at 300 rpm and left over night, in order to detect the effect of the used dose in the coagulant performance (Djamel and Ahmed, 2015). The mud used greater than the recommended for aluminum salts, but this is due to the fact that the mud has aluminum in its composition but aluminum salts are not the only constituents in the mud.

In all performed tests the supernatant pH was greater than 7.8 for all the coagulant doses and for all the mud tested. Since the final pH is in alkaline range we have concluded that the predominant coagulation mechanism was the mechanism of sweep flocc with formation of precipitate that involves and drag the suspended particles. During the wastewater treatment process hydroxide precipitates are formed. The suspended contaminants are removed by hetero coagulation or are enmeshed by the precipitates; destabilization mechanisms also mentioned by Brian Dempsey. The soluble contaminants are adsorbed on the precipitates.

The composite tannery wastewater tested has a COD, 4912 mg/l, BOD, 2690 mg/l and content in suspended solids ranged from 3312 mg/l. It is clear from the Tables 3 and 4 that the anodizing mud tested have effectively, through coagulation process contributed the removal of the wastewaters total solids, total dissolved solids, total suspended solids, grease and oil, sulphate, sulfide, chromium, C.O.D and B.O.D reaching the removal of pollutants to maximum values 59.9%, 53.8%, 87.1%, 100%, 34.1%, 100%, 99.0%, 70.3% and 67.0% respectively.

The optimum pH ranges for anodizing mud, for treating tannery wastewater were 7.81 to 8.22.

For statistical validation it has been mentioned Fig. 4 and 5. This coagulation process was effective and it was visible the formation of flocs which settled rapidly. The size of the flocs formed depends on the agitation conditions and mud dose used. The coagulation process observed with the mud occurred in pH zone between 7.8 and 8.22, which according to the coagulation diagram for aluminum salts proposed by Lofrano (Lofrano et al, 2006), is the pH zone, there is predominance of the mechanisms in a precipitate.

The precipitate mechanism will act in the following way; precipitation of the metal hydroxide and contaminants removal by enmeshment in this precipitate. Soluble contaminants are adsorbed on the hydroxide and particles are removed by hetero coagulation (Duan and Gregory, 2003). Also according to Amirtharajah (Amirtharajah and Mills 1983) (the hydroxide is positively charged when the pH is less than 8.0, so, in the range of the tests the precipitate is positively charged and the enmeshment mechanism is enhanced by hetero coagulation between the precipitate and the negatively charged suspension. The sweep flocculation mechanism gives improved particle removal comparatively with the mechanism of charge neutralization. Hydroxide precipitates have a rather open structure having a higher probability of capturing other particles. This can explain the high removal rates achieved in the flocculation experiments with the anodizing sludge. All experiments were carried out in duplicates.

The results for the suspension mud that the same conditions of stirring, settling time and supernatant reduction. This is the fact that when dealing with a powder, the dissolution process is very important to ensure that the aluminum present acts as coagulant, and to make the maximum use of the coagulation substances present. The presence of a considerable percentage of
aluminum in the chemical composition of the sludge solid fraction is the main factor that contributes to the sludge coagulation capacity.

**Conclusion**

This research presented results of an experimental study of flocculation/coagulation process used in tannery wastewater treatment. Coagulation efficiency was determined by COD, BOD, Suspended Solids, Sulfide, Oil & Grease and Chromium measuring of the supernatants in the Jar test. It was found that anodizing mud were more efficient as coagulants. It is the least effective since 5.0 gm of the anodizing mud through the experimental work. Flocc formation is observed and floccs are easily separated from the supernatant by settling, when the amount of anodizing mud increased 5.0 gm, the flocc settling times increased.

Also, for two tested sludge, the coagulant in suspension form presents better results for contaminants reduction. The treated tannery wastewater was not suitable for discharge into receiving waters as the many residual pollutants greater than NEQS limits. Tannery wastewater efficiency was not achieved by anodizing mud. Therefore, further advanced or biological treatment is needed for tannery wastewater.

The work was carried out at lab scale and may be extended to large scale. The use of anodizing mud for treatment of tannery waste water will act as an effect coagulant on one hand and will prevent under discharge of the anodizing mud in sewer on the other hand.

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**Table – 1**

**Analysis of anodizing mud Suspension**
*(All analytical analysis was performed in duplicate)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture%</td>
<td>81</td>
</tr>
<tr>
<td>Ph</td>
<td>7.4</td>
</tr>
<tr>
<td>Sulphate, total (SO₄) (%)</td>
<td>14</td>
</tr>
<tr>
<td>Aluminum, total (Al) (%)</td>
<td>22</td>
</tr>
<tr>
<td>Sodium, (Na) (%)</td>
<td>0.17</td>
</tr>
<tr>
<td>Calcium, (Ca) (%)</td>
<td>0.062</td>
</tr>
<tr>
<td>Tin, (Sn) (%)</td>
<td>5.0</td>
</tr>
<tr>
<td>Chromium total (Cr) (mg/ kg)</td>
<td>4.5</td>
</tr>
<tr>
<td>Chromium VI (Cr) (mg/ kg)</td>
<td>3.2</td>
</tr>
</tbody>
</table>

**Table – 2**

**Analysis of tannery wastewater**
*(All analytical analysis was performed in duplicate)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results in ppm except pH</th>
<th>NEQS Limits Value (National Environmental Quality Standards)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1st Sample</td>
<td>2nd Sample</td>
</tr>
<tr>
<td>pH value</td>
<td>8.36</td>
<td>8.35</td>
</tr>
<tr>
<td>Total solids</td>
<td>29878</td>
<td>12258</td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>23306</td>
<td>10560</td>
</tr>
<tr>
<td>Total suspended solids</td>
<td>6275</td>
<td>1698</td>
</tr>
<tr>
<td>Grease and oil</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>Sulphate</td>
<td>6450</td>
<td>6302</td>
</tr>
<tr>
<td>Sulphide</td>
<td>200</td>
<td>175</td>
</tr>
<tr>
<td>Chromium</td>
<td>2052</td>
<td>1903</td>
</tr>
<tr>
<td>COD</td>
<td>5360</td>
<td>4720</td>
</tr>
<tr>
<td>BOD</td>
<td>3030</td>
<td>2860</td>
</tr>
</tbody>
</table>
Table – 3
Influence on removal of pollutants from the Tannery effluent’s composite sample with increasing dose of coagulant mud dry.
(All analytical analysis was performed in duplicate)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Fresh Composite Sample</th>
<th>Results in ppm except pH</th>
<th>Coagulation dose (Dry)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.5 gm</td>
<td>1.0 gm</td>
</tr>
<tr>
<td>pH value</td>
<td>8.28</td>
<td>8.09</td>
<td>8.01</td>
</tr>
<tr>
<td>Total solids</td>
<td>17966</td>
<td>14856</td>
<td>17.3</td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>14654</td>
<td>12376</td>
<td>15.5</td>
</tr>
<tr>
<td>Total suspended solids</td>
<td>3312</td>
<td>2480</td>
<td>25.1</td>
</tr>
<tr>
<td>Grease and oil</td>
<td>21</td>
<td>No Traces</td>
<td>100</td>
</tr>
<tr>
<td>Sulphate</td>
<td>6376</td>
<td>6091</td>
<td>4.4</td>
</tr>
<tr>
<td>Sulphide</td>
<td>165</td>
<td>No Traces</td>
<td>100</td>
</tr>
<tr>
<td>Chromium</td>
<td>1924</td>
<td>1456</td>
<td>24.3</td>
</tr>
<tr>
<td>COD</td>
<td>4912</td>
<td>4350</td>
<td>11.4</td>
</tr>
<tr>
<td>BOD</td>
<td>2690</td>
<td>2374</td>
<td>11.7</td>
</tr>
</tbody>
</table>
Table 4
Influence on removal of pollutants from the Tannery effluent’s composite sample with increasing dose of coagulant mud suspension.
(All analytical analysis was performed in duplicate)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Fresh Composite Sample</th>
<th>Results in ppm except pH</th>
<th>Coagulation dose (Suspension)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5 gm</td>
</tr>
<tr>
<td>pH value</td>
<td></td>
<td></td>
<td>8.28</td>
</tr>
<tr>
<td>Total solids</td>
<td>17966</td>
<td></td>
<td>1496</td>
</tr>
<tr>
<td>Total dissolved solids</td>
<td>14654</td>
<td></td>
<td>1234</td>
</tr>
<tr>
<td>Total suspended solids</td>
<td>3312</td>
<td></td>
<td>2619</td>
</tr>
<tr>
<td>Grease and oil</td>
<td>21</td>
<td></td>
<td>No trace s</td>
</tr>
<tr>
<td>Sulphate</td>
<td>6376</td>
<td></td>
<td>6112</td>
</tr>
<tr>
<td>Sulphide</td>
<td>165</td>
<td></td>
<td>No trace s</td>
</tr>
<tr>
<td>Chromium</td>
<td>1924</td>
<td></td>
<td>1691</td>
</tr>
<tr>
<td>COD</td>
<td>4912</td>
<td></td>
<td>4509</td>
</tr>
<tr>
<td>BOD</td>
<td>2690</td>
<td></td>
<td>2347</td>
</tr>
</tbody>
</table>
Figure -1: Anodizing Mud (suspension)
Gender Issues in Hindi Language Family Based Teleserials

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Abstract- Teleserials in India constitute major share of the time devoted to entertainment programmes on the Hindi language channels of Indian television. In India, teleserials rose to popularity after Humlog, the first TV serial that became a major success on Doordarshan. Liberalization and globalization led to the private channels started telecasting mega serials about big business families. The year 2008 led to the birth of Colors TV as a new channel, and Balika Vadhu, as a women centric thematic soap. A new shift in the emphasis in the content of family based teleserials was observed. UN and CEDAW guidelines as well as Beijing 20 laid emphasis on portrayal on women in media and its linkages with gender empowerment. Content of teleserials became a question of primary concern.

As a part of the doctoral study on ‘Gender issues in the Hindi language family based teleserials’, an analysis of the primary themes of the content of 182 teleserials on Youtube over the time frame 2008-2016 was conducted across four popular Hindi channels i.e. Starplus, Zee TV, Sony and Colors within the context of gender. A total of 182 family based teleserials were telecasted across the four identified channels between 2008-2016. Of them, 87 teleserials (47.80%) revolved around women and gender. Out of a total of 87 gender centric teleserials, 47 teleserials had some issue related to gender as their primary theme; 31 teleserials focused on the challenging life journeys of women in a diversity of situations as the primary theme; and 11 teleserials focusing on women centric relationships. Among the 47 teleserials focusing on gender issues, 32 teleserials focused on issues related to marriage and gender, 03 teleserials focused on issues related to gender based discrimination, 04 teleserials focused on issues related to gender based violence; and 08 teleserials focused on a variety of other gender issues as their primary theme. Channel wise, more than 50% of teleserials on ZeeTv, Sony tv and Colors Tv had gender as the primary theme. Starplus, though had the highest number (28), the proportion was 40.00%.

Keywords: Family based teleserials, gender issues, women centric teleserials, challenging life journeys of women, gender and relationships.

1. Introduction

Teleserials in India constitute 80-90% of the time devoted to entertainment programmes on the Hindi language channels of Indian television. Soap operas or teleserials have stories generally revolving around 2 to 5 families associated with each other. All teleserials have a central theme, have basic plot and sub plots. They are slow and stories reach viewers’ homes daily. Stories may have one or more protagonist. The viewers develop a symbiotic relationship with the protagonist and the key characters of the teleserials. Viewers get involved with the content and context of the story at the level of their psyche.

Teleserials in India rose to popularity after Humlog, the first TV serial that became a major success on Doordarshan, followed by many others like Udaan, Buniyaad, Ramayan and Mahabharata on Doordarshan in the pre-liberalization era. Doordarshan tried to define the televiewing space of teleserials appealing to the Indian-ness of the Indian audience.

Post liberalization and globalization, the private channels started telecasting mega serials about big business families and their family relationships focusing on the household issues and concerns. In the post liberalization and globalization era, teleserials like Kyunki Saas Bhi Kabhi Bahu Thi, Kasauti Zindagi Ke, and Kahaani Ghar Ghar Ki rose to unparallel popularity (Munshi, 2012).
Kyunki’ and ‘Kahaani’ redefined televiewing space through their mega stories, film like visual quality, and a content that brought day to day household level issues of relationships and spaces to people’s homes. ‘Tulsi’ and ‘Parvati’ became popular household names. Many such teleserials journeyed for more than 4-5 years including the likes of Kausauti, Kyunki and Kahaani. Due to their unending length and stories loosing relevance running across generations, these teleserials started inviting a lot of criticism towards the end. Gender as a concern was beginning to find negative treatment through some of these serials.

In the year 2008, with the birth of Colors TV as a new channel, and Balika Vadhu, there was sudden new shift in the emphasis in the content of family based teleserials (Kottary, 2009). Content wise and context wise, there were efforts to focus on women’s voices, concerns and struggles in some way. Gender as a concern was beginning to find a specific voice and space.

1.1 Theoretical framework
1.1.1 The question of content and context: Given the very high popularity of teleserials, the question of content and context with respect to gender needs to be reviewed as the images, issues and stories carried in the teleserials have a high potential of influencing the viewers in some way. The influence could be positive or negative, constructive or destructive, and short term and long term. The Cultivation theory and the Socialization theory of Media Effects by Denis McQuail also state the role of mass media, particularly the entertainment programmes in influencing the viewers in subtle manner (McQuail, 2010).

1.1.2 Understanding gender and sex: The concept of gender enables us to state that sex and gender are different. Sex is biological, helping to categorize people in to male and female; and gender is sociological. The distinct socially and culturally created and perceived roles of men and women are called gender. Gender therefore is the social and cultural definition of men and women (Bhasin, 1999 and Bhasin 2000).

1.1.3 Global initiatives on women and media The Beijing Platform for Action’, set up in 1995, emphasized on the need for the media to play a role in shifting the gender stereotypes. Twenty years later, again, the Beijing 20 emphasized, that ‘Everyone deserves to live free from the burden of harmful gender stereotypes’ (Beijing 20, 2015).

An ongoing UNESCO-SWAN (South Asian Women’s Network) initiative, ‘Women for Change: Building a Gendered Media’ in May 2016 developed a set of practical gender sensitive guidelines for women in media in the South Asian Region (UNESCO, New Delhi, 2016).

CEDAW, UNIFEM in its 2006 report focused on the linkages between Sex Role Stereotyping and Prejudice, Status of Women in India and Role of Media.

It stated that the absence of clear censor guidelines on sexual stereotypes had resulted in the glorification of women’s subordination through unhindered media portrayals. It stressed that ‘the absence of any regulations in television programmes resulted in a stereotype typical portrayal of women in serials. (CEDAW, UNIFEM, 2006).

Gender Recommendation No. 19 of the CEDAW Committee clearly pointed that ‘cultural practices/attitudes, perpetuate widespread practices involving violence or coercion’. Such practices had the potential to justify gender-based violence.

1.1.4 The Indian context- Broadcasting Contents Complaints Council (BCCC) was set up in India to regulate the content of cable Television. The BCCC guidelines were applicable to all non-news broadcast programmes on television. The guidelines discourage portrayal of women as ‘an object of sexual exploitation’ and discourage glorification ‘of social evils like child marriage, dowry, bigamy, son preference’ etc (IBF Guidelines).

2. Content analysis of Hindi language family based teleserials

Trends in content of the Hindi language family based teleserials in general as well as content related to gender and women were studied through an analysis of the primary thematic treatment of the story. A study was conducted for analysis for primary themes of the content and storyline of family based teleserials over the time frame 2008-2016. Epic and mythological teleserials were excluded from the sample Teleseries like crime shows, talk shows, talent shows etc were also excluded.

2.1 Content analysis: To analyze the trends in content of the family based Hindi language teleserials telecasted 2008 onwards, with respect to gender and women, data was gathered by visiting the websites of each channel. Data was gathered over the time frame of
2008-2016 four popular channels identified for inclusion in the study were Starplus, Sony, Zee TV, Colors, since these were the most popular channels. Also other channels were excluded for the purpose of manageability of the data.

2.2 Methodology: Each teleserial on air between 2008-2016 was studied briefly for an idea of its basic storyline, content, background and type of teleserial. Teleserials were visited through their channel websites and Youtube. Teleserials on air as on 2008 even if they were continuing from the past were also included. This exercise was undertaken to study the trends in content and range.

3. Analysis: Based on their thematic content and basic storyline, three broad categories of content emerged among the teleserials. The three broad categories arrived that emerged were General (Themes related to family and social life with no specific emphasis on gender or women); Gender centric (stories around women protagonist or issues related to women or gender as a primary focus); and Gender as an issue built into script (primary theme did not revolve around women or gender but some aspect of gender roles emerged as a part of the story).

3.1 Channel wise classification of teleserials (2008-2016)

Table 1 reveals that a total of 182 family based teleserials were telecasted across the four identified channels between 2008-2016. Of them, 87 teleserials (47.80%) revolved around women and gender, either focusing on stories women protagonists or some gender issues. Channel wise even though Starplus (28) had the highest number of gender centric teleserials, proportion wise Zee, Sony and Colors were nearly equal and fared much higher than Starplus. More than half of the family based teleserials on Zee TV, Sony and Colors revolved around women and gender as the primary theme.

<table>
<thead>
<tr>
<th>Name of channel</th>
<th>Number of Teleserials (Total) (N)</th>
<th>Family based teleserials (Total) (n)</th>
<th>Family based Gender centric teleserials (n1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starplus</td>
<td>74</td>
<td>70</td>
<td>28 (40.00%)</td>
</tr>
<tr>
<td>Colors</td>
<td>45</td>
<td>42</td>
<td>22 (52.38%)</td>
</tr>
<tr>
<td>Zee TV</td>
<td>41</td>
<td>39</td>
<td>21(53.84%)</td>
</tr>
<tr>
<td>Sony</td>
<td>33</td>
<td>31</td>
<td>16 (51.61%)</td>
</tr>
<tr>
<td>Total</td>
<td>193</td>
<td>182</td>
<td>87 (47.80%)</td>
</tr>
</tbody>
</table>

3.1.1 Gender centric teleserials; channel wise thematic analysis

An analysis of the content of gender centric teleserials based on the primary theme around which the story revolved; conducted channel wise as well as theme wise, led to the following classification. Based on the primary theme of the content, the gender centric teleserials were classifiable in to three broad categories: a. Teleserials around specific gender issue, b. Challenging life journeys of women protagonists in the teleserial as the primary focus; and c. Relationships challenges of the women protagonists as the primary focus.

3.2 Themes and issues raised in gender centric teleserials

A channel wise analysis of the trends in gender centric scripts of the teleserials is presented below.

3.2.1 Starplus: Out of the 28 teleserials in the gender centric category, all the teleserials revolved around stories and life journeys of women protagonists in some way. Among them, 16 out of 28 teleserials were scripted around specific gender linked issues in family or society; 08 teleserials had stories around courageous and challenging life journeys of women in diverse tough situations; and 04 teleserials focused primarily on diversity of relationships of women and their challenges. Starplus aired 04 teleserials with stories originating in rural areas in the gender centric category.

The 17 teleserials focusing on gender centric issues included 10 teleserials around issues related to marriage.
Table-2 Teleserials on gender and marriage (Starplus)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial Starplus</th>
<th>Primary theme</th>
<th>issue- Gender and marriage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Kumkum- Ek pyara sa bandhan</td>
<td>Widow remarriage.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Zindagi ka har rang gulal</td>
<td>Remarriage between brother in law and sister in law</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Sapna babul ka… Bidaai</td>
<td>Fair and dark complexion discrimination</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Diya aur bati hum</td>
<td>Balance between home and work</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Ek nanad ki khushiyo ki chhabi… meri bhabhi</td>
<td>Loving bond between two sisters in law</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Sasural genda phool</td>
<td>Class issues and marriage</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Mitwa phool kamal ke</td>
<td>Orthodox practices related to marriage in UP.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Sajan Ghar jana hai</td>
<td>Non acceptance of daughter in law from lower caste.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Chehra</td>
<td>Marriage of disabled girl on a wheelchair</td>
<td></td>
</tr>
</tbody>
</table>

The range of issues around marriage encompassed widow remarriage including remarriage between widowed sister in law with brother in law in rural Gujarat (02), preference for fair complexion in marriage and struggles of a girl with dark complexion to find a match (01), life journey and marriage of woman with disability who is wheel chair bound (01); non acceptance of daughter in law from lower caste in an upper caste home (01), marriage adjustment and class issues (01), rituals and orthodox practices related to marriage in UP (01), a woman’s dream for higher education, career and family support after marriage to become an IPS officer(01); loving, caring, bond of happiness and love between two sisters in laws (01); and search for identity of a girl child, not accepted as a result of the parent’s interfaith marriage (01).

Table-3 Teleserials on gender based violence (Starplus)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial Starplus</th>
<th>Primary theme</th>
<th>issue- Gender based violence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mann ki awaaz pratigya</td>
<td>Rape, stalking.</td>
<td></td>
</tr>
</tbody>
</table>

The next category of issues that surfaced were violence against women, rape, stalking and victimization (2 teleserials). Both teleserials had issues of violence and rape with in the household due to class, caste and clout.

Table-4 Teleserials on gender based discrimination (Starplus)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial Starplus</th>
<th>Primary theme</th>
<th>issue- Gender based discrimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ek veer ki adaas-veera</td>
<td>Non acceptance of girl child, brought up by kid brother.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Everest</td>
<td>Daughter’s desire to scale Mount Everest for acceptance by father.</td>
<td></td>
</tr>
</tbody>
</table>

Two teleserials revolved around girl child rejected by the family. This included girl child rejected by the father and daughter’s craving for acceptance by climbing Everest(01), and girl child rejected by the family brought up by the kid brother (01).
Table-5 Teleserials on other gender issues (Starplus)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Primary theme</th>
<th>issue- Other gender issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Shraddha</td>
<td>Char Dham Yatra of parents, daughter’s dream.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Tamana</td>
<td>Women and cricket</td>
<td></td>
</tr>
</tbody>
</table>

The other gender issues arising in the teleserials on Starplus included a daughter’s desire to take her parents for Char Dham Yatra normally supported by sons (01), and women and sports with Tamana’s desire to become a cricketer(01).

Some teleserials may fall in more than one category but they have been grouped in the specific category based on the primary theme or issue that it focused on. It is interesting to note that each serial in some way will fall under the category of gender based discrimination/ violence. Any discrimination based on sex can be understood as a form of violence. Also most teleserials in the other gender issues category may also fall in the category of discrimination or violence. They have been grouped separately because of a larger issue that they focus on.

Table-6 Teleserials on challenging life journeys (Starplus)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial Starplus</th>
<th>Primary theme</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dosti... Yariyaan… Manmarziyan</td>
<td>Women’s empowerment and self discovery</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Sapno Se Bhare Naina</td>
<td>Self discovery and self empowerment</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Ruk jana nahi</td>
<td>Women empowerment in male dominated society.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Sangam</td>
<td>Daughter’s efforts to strengthen her family.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Grihasti</td>
<td>Journey of self discovery seven women after the death of patriarch.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Kasturi</td>
<td>Difficult life journey through betrayals</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Mohi… Ek khwaab ke khilne ki kahaani</td>
<td>Life of a tribal girl named Mohi.</td>
<td></td>
</tr>
</tbody>
</table>

Starplus telecasted 08 teleserials with stories focusing on the tough and challenging life journey of women protagonists in some way. Among them 07 stories focused on challenging life journeys of women protagonists themself finding a way for self discovery and empowerment in some way. One story focused on life journey of seven women in a family impacted by the death of male patriarch (Grihasti).

Among the seven stories of women, two teleserials were based on journeys of young women for self discovery and self empowerment (Dosti Yariyaan… and Sapno se bhare Naina). Two stories focused on efforts of the protagonist in facing the male dominated society and uplifting their parental family (Ruk jana nahi, Sangam). Navya was a unique story of a girl upholding family values, post marriage, uniting the family and improving the status of women in the matrimonial family through her new empowering ideas and efforts. One story of love and betrayal in the tough life journey of woman in family and relationships (kasturi). Mohi was a unique teleserials focusing on the life dreams and challenges of a tribal girl.

Table-8 Teleserials on gender and relationships (Starplus)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial Starplus</th>
<th>Primary theme and relationships</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Suhani si ladki</td>
<td>Difficult life journey of Suhani</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Sabki Laadli bebo</td>
<td>story of the Bebo and her relationships</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Behenein</td>
<td>Sacrifices of sisters</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Ek hazaro mein meri behna hai</td>
<td>Sister’s love.</td>
<td></td>
</tr>
</tbody>
</table>

In the teleserials on gender and relationships category, out of total of four teleserials, two teleserials focused on relationships between sisters, and one story on relationships challenges post marriage (Suhani si ladki) and supportive relationships for Bebo in her parental family (Sabki Laadli bebo).
3.2.2 Colors TV
Colors TV channel aired 22 gender centric teleserials. Among these 14 stories focused primarily on one or more than one gender issue. Of these, 08 teleserials had issues related to marriage as the primary theme, one teleserials focused on gender based discrimination as the primary theme and two teleserials focused on gender based violence as the primary theme. A total of three teleserials focused on other gender based issues.

There were a total of 04 stories on difficult life journeys of women protagonists facing societal challenges, and 04 stories focusing primarily on women protagonists and their relationships.

Out of a total of 22 gender centric teleserials, Colors TV telecasted 07 teleserials contextualized in rural areas.

<table>
<thead>
<tr>
<th>Table-9 Teleserials on gender and marriage (Colors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.no.</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
<tr>
<td>6.</td>
</tr>
<tr>
<td>7.</td>
</tr>
<tr>
<td>8.</td>
</tr>
</tbody>
</table>

Out of a total of 08 teleserials around issues related to gender and marriage, two teleserials focused on widow remarriage (Na Bole Tum Na Maine Kuchh Kaha, Ishq Ka Rang Safed) and one teleserial on the issue of child marriage in rural Rajasthan (Balika Vadhu). The range of other issues related to marriage surfacing in teleserials on Colors TV included Dowry (Bandhan Saat Janamon Ka), marriage by abducting a bride groom at gun point as a tradition in Bihar (Bhagya vidhaata), forceful marriage of a poor slum girl with a black painted face to save the life of a rich gangster (Laagi Tujhse Lagan); and problems of a stammering girl in finding a suitable match for her marriage (Thapki Pyar Ki).

One teleserial focused on fate of a rape victim in village forcefully married to royalty because of rape committed by the prince of royal family (Aise Karo Naa Vidaa).

<table>
<thead>
<tr>
<th>Table-10 Teleserials on gender based violence (Colors)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.no.</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
</tbody>
</table>

The category of gender based violence included two teleserials. Na aana is des laado had female feticide and primary focus even though it included a huge range of issues related to gender based violence including rape, domestic violence, discrimination etc. Phulwa was a unique story loosely based on the life of bandit queen Phoolan Devi.
Table-11 Teleserials on gender based discrimination (Colors)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Colors</th>
<th>Primary theme</th>
<th>issue-</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mere Ghar Aayi Ek Nanhi Pari</td>
<td>TV</td>
<td>Birth of a girl child after many years.</td>
<td></td>
</tr>
</tbody>
</table>

In the section of gender based discrimination, Mere Ghar Aayi Ek Nanhi Pari was the story of positive approach welcoming the birth of a girl child in family after 18 years.

It is important to mention here the case of Balika Vadhu and Na aana is desh lado. Both the serials started with one primary issue but took a lifecycle approach and touched a huge range of gender centric issues as a part of the story and situations. Balika Vadhu started with the primary focus on child marriage but went on to handle issues associated with women personal and social life like literacy, access to health, discrimination, status in family and society, widowhood, employment, separation, remarriage etc. Na aana is desh lado started primarily on female feticide but touched a very broad range of gender issues like violence, rape, victimization, lack of human rights etc. Most other serials focused on one primary issue and its contextualization in to the script.

Table-12 Teleserials on other gender issues (Colors)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Colors</th>
<th>Primary theme</th>
<th>issue-</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Agni pareeksha Jeevan Ki —Gangaa</td>
<td>TV</td>
<td>Superstitions regarding skin disease in a girl.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Krishna dasi</td>
<td>TV</td>
<td>Life of Devdasis.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Udaan</td>
<td>TV</td>
<td>Girl child sold as bonded labor.</td>
<td></td>
</tr>
</tbody>
</table>

The list of other gender issues in the table above is self-explanatory. Other issues included life of Devdasis, bonded labor of a girl child sold even before birth; and superstitions regarding skin disease in a girl and the societal pressures face by her.

Table-13 Teleserials on challenging life journey (Colors)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Colors</th>
<th>Primary theme</th>
<th>Challenging life journey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rangrasiya</td>
<td>TV</td>
<td>Abduction and forceful marriage of a girl to gun smuggler.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Madhubala</td>
<td>TV</td>
<td>Life journey through tough circumstances.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Maati ki Banno</td>
<td>TV</td>
<td>Young orphan girl journey to search for her family.</td>
<td></td>
</tr>
</tbody>
</table>

Of the four stories on difficult life journeys of women protagonists, three stories focused largely on tough life journey through relationships in difficult circumstances to find love (Madhubala, Bani, Rangrasaiya); and one story focused on the tough journey of an orphan girl to search for her land and family.

Table-14 Teleserials on gender and relationships (Colors)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Colors</th>
<th>Primary theme</th>
<th>Gender and relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Swaragini</td>
<td>TV</td>
<td>Bonding between sisters</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Shastri Sisters — Chaar Dil Ek Dhadkan</td>
<td>TV</td>
<td>Bonding between sisters</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Sasural Simar ka</td>
<td>TV</td>
<td>Marriage and family relationships.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Uttaran</td>
<td>TV</td>
<td>Caste and class issues in friendship</td>
<td></td>
</tr>
</tbody>
</table>

Among the four stories focusing only on the relationships of women protagonists, two stories revolved around relationships between sisters (Swaragini, Shastri Sisters- Chaar Dil Ek Dhadkan and one story around life journey of challenges in relationships post marriage (Sasural Simar ka).
One story on challenging relationships of two friends from different class and caste backgrounds brought up together, and their different life outcomes (Uttaran).

3.2.3 Sony TV

Sony TV channel aired a total of 16 teleserials in the gender centric category. Of them, seven teleserials were based on specific gender issues as primary theme, eight teleserials were based on challenging tough life situations and life journeys of women in the personal and socio economic front and their self development in some way. One teleserial focused only on the challenges of gender centric relationships of women protagonists.

Table-15 Teleserials on gender and marriage (Sony TV)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Sony TV</th>
<th>Primary theme</th>
<th>issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ekk Nayi Pehchaan</td>
<td></td>
<td>Loving bonds between Daughter In law and mother in law.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Tum aise hi rehna</td>
<td></td>
<td>Expectations of a wife from marriage</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Aathvaan Vachan</td>
<td></td>
<td>Mental health care of the girl child</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Godh bharaai</td>
<td></td>
<td>Infertility and social attitude.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Sujata</td>
<td></td>
<td>Mother’s Sacrifices for her family</td>
<td></td>
</tr>
</tbody>
</table>

All the six issue based teleserials had stories revolving around issues associated with gender and marriage. Among them, two stories focused on gender role expectations and relationships in marriage. Ekk Nayi Pehchaan brought to surface a positive relationship between daughter in law and mother in law as a positive example. Tum aise hi rehna focused on the gender roles and expectations of a wife from her husband after marriage.

Baat hamari pakki hai focused on the problems in finding a suitable match, and marriage of an adopted orphan girl by her relatives. Aathvaan Vachan focused on the issue of responsibility of mental health care for girl child with mental health issues after the marriage of her sister, accepted by the brother in law.

On the issue of motherhood, one teleserial focused on the differential social treatment in dealing with the Infertility of men and women (Godh bharaai). Sujata was the women centric story of the sacrifices of a mother named Sujata for her family.

There was no teleserial focusing on girl child discrimination and gender based violence as the primary theme as a singular issue on Sony TV.

Table-16 Teleserials on other gender issues (Sony TV)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Sony TV</th>
<th>Primary theme</th>
<th>other gender issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Palampur Express</td>
<td></td>
<td>Women and Olympics.</td>
<td></td>
</tr>
</tbody>
</table>

Palampur Express was the story of meeting challenging personal aspirations of a girl and her struggle against all personal and social odds to become an Olympic runner.

Table-17 Teleserials on challenging life journey (Sony TV)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Sony TV</th>
<th>Primary theme</th>
<th>Challenging life journeys</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Krishnaben khakhrawala</td>
<td></td>
<td>Women empowerment and inspiration for others.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Desh ki beti Nandini</td>
<td></td>
<td>Challenging life of a daughter and citizen.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Kehta hai dil jee le zara</td>
<td></td>
<td>Sacrifices of a daughter to support her family on</td>
<td></td>
</tr>
</tbody>
</table>
Sony TV telecasted eight teleserials on challenging life journey of women in a diversity of tough situations and achievement of their challenging life goals. A widow’s journey to bring up her children and become an example of women empowerment and support to others (Krishnaben khakhrawala); exemplary journey of a young woman to become a responsible family member and citizen (Desh ki beti Nandini); struggles and sacrifices of a daughter to support her family and business after her father’s death (Kehta hai dil jee le zara) and a daughter’s trial in conflicting ethics in fathers business (Virudh) were stories of challenges faced by women in the socio economic and personal fronts. Baytaab dil kee tamannaha focused on challenging journey of three girls from a small town after the death of the parents.

Two other stories of challenges on the personal, ethical and moral fronts included journey of Moniya, a longlost princess who reaches her family, finds her relationships and rules her kingdom based on human values (Dekha ek khwab) and a woman’s journey to find love and marriage (Meet Mila de Rabba).

One teleserial brought attention to the issue of conjoined twins and their life journey (Amber Dhara)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Sony TV</th>
<th>Primary theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Hum Ladkiyaan - Mayke se sasural tak</td>
<td>Gender and relationships</td>
<td>Four friends and their dreams and relationships.</td>
</tr>
</tbody>
</table>

Sony TV telecasted only one teleserial focusing only on women and their relationships (Hum Ladkiyaan - Mayke se sasural tak). It focused on dreams and relationships of women with self, family and marriage. The teleserial focused largely on the journey of relationships with parental home and matrimonial home.

### 3.2.4 Zee TV

Zee TV channels aired 21 teleserials in the gender centric category. Among them, 10 teleserials focused on specific gender issues, 09 teleserials focused on the tough life journey of women protagonists in challenging situations, in meeting their dreams, self discovery and empowerment; and two teleserials focused on relationship of women protagonists. Only one teleserial in the entire list revolved around a male protagonist, portraying a non conventional son in law playing a positive role in the life of his wives’s family.

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Zee TV</th>
<th>Primary issue- gender and marriage</th>
<th>theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Saat Phere: Saloni ka Ghar</td>
<td>Dark complexion girl and struggles for marriage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>12/24 Karol Bagh</td>
<td>Late marriage, compromises.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Agle Janam Mohe Bitiya Hi Kijo</td>
<td>Purchase of young brides in Bihar to produce son.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Banoo Main Teri Dulhan</td>
<td>Marriage of mentally unstable man to a poor girl.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Ten teleserials with gender centric issue as the primary theme included eight teleserials around gender and marriage and its diverse dimensions and two teleserials around other gender issues.

The eight teleserials around issues related to marriage included two stories on challenges and problems of finding a suitable match. The first focused on finding a match for a dark complexioned girl even if she is a very good human being (Saat Phere: Saloni ka Ghar); and the second teleserial focused on stigma, issues associated with late marriage of a young Punjabi girl and implications on her life and family (12/24 Karol Bagh).

The practice of purchase of young poor brides in Bihar for producing a son, struggles of women sold in such marriages (Agle Janam Mohe Bitiya Hi Kijo) was the only story from rural background focusing on multiple issues.

Story of a fraudulent marriage and cheating of a poor young girl married to a rich mentally unstable man and her challenging life (Banoo Main Teri Dulhan); abusive marital relationship, separation and implications (Doli Armaano Ki) were other issues associated with gender and marriage.

Three teleserials focusing on marriage and relationships included a comedy on relationships in a home with seven mothers in law (Satrangi Sasural); and two teleserials on positive non conventional relationships in marriage. These included a positive role model of a bond between a mother in law and daughter in law as an example of positive social change (Meri susu ma), and a non conventional son in law playing a positive role in the life of his wives’s family (Jamai Raja).

There was no teleserial focusing on girl child discrimination and gender based violence as the primary theme as a singular issue on Zee TV. However serials like Saat Phere, 12/24 Karolbagh, Agle janam mohe bitiya hi kijo, Doli armaano ki and Banoo mai teri dulhan had multiple components of discrimination and violence as sub themes in their stories.

### Table-20 Teleserials on other gender issues (Zee TV)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Zee TV</th>
<th>Primary theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Aapki Antara</td>
<td></td>
<td>Life of an autistic girl child.</td>
</tr>
<tr>
<td>2.</td>
<td>Kala teeka</td>
<td></td>
<td>Superstitions/ discrimination between own and adopted girl child.</td>
</tr>
</tbody>
</table>

The two teleserials on other gender issues included one daring teleserial focussing on problems of an autistic girl child and her life journey, struggles and relationships (Aapki Antara); and one teleserial focusing on superstitions to use an adopted dark complexioned poor orphan girl to ward off evil eye on the real fair daughter (Kala teeka).

### Table-21 Teleserials on challenging life journey (Zee TV)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Zee TV</th>
<th>Primary theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Afsar Bitiya</td>
<td></td>
<td>Higher education and career for women, self empowerment.</td>
</tr>
<tr>
<td>2.</td>
<td>Mera Naam Karegi Roshan</td>
<td></td>
<td>A daughter’s crusade for justice and equality.</td>
</tr>
<tr>
<td>3.</td>
<td>Ghar ki Lakshmi Betiyann</td>
<td></td>
<td>Daughter’s right to equity in parental home and women’s empowerment</td>
</tr>
</tbody>
</table>
Out of a total of 09 teleserials on tough life journey of women and girls in difficult challenging situations, three teleserials on journey related to self development and women’s empowerment included struggles of women protagonists for higher education and career (Afsar Bitiya), struggles for right to equity and empowerment (Ghar ki Lakshmi Betiyan); and fight against injustice and inequality in family and society (Mera Naam Karegi Roshan).

Two teleserials focused on struggles and sacrifices of daughters to support and uplift their families in crisis (Yahaan main ghar ghar kheli, Hitler Didi). Two teleserials had stories around the dreams, personal aspirations for self development and struggles of women protagonists (Zindagi Ki Mahek, Sapne Suhane Ladakpan Ke). One story focused on the tough life journey of three sisters after the demise of their parents (Kasamh Se). There was one story on the tough life journey of two orphan girl children (Chhoti Si Zindagi).

<table>
<thead>
<tr>
<th>No.</th>
<th>Serial Name</th>
<th>Theme Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Yahaan main ghar ghar kheli</td>
<td>Daughter’s struggles to save her heritage parental property</td>
</tr>
<tr>
<td>5.</td>
<td>Hitler Didi</td>
<td>Daughter’s efforts to bring up her family and fight social evils.</td>
</tr>
<tr>
<td>8.</td>
<td>Sapne Suhane Ladakpan Ke</td>
<td>Young women and their dreams for self development.</td>
</tr>
</tbody>
</table>

Table-22 Teleserials on gender and relationships (Zee TV)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Channel/ Name of the serial</th>
<th>Zee TV</th>
<th>Primary theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Maayka</td>
<td></td>
<td>Relationships of three sisters with their parental home.</td>
</tr>
<tr>
<td>2.</td>
<td>Do Saheliyaan</td>
<td></td>
<td>Friendship between two girls of different caste and class.</td>
</tr>
</tbody>
</table>

Zees TV channel telecasted only two teleserials around relationships of women. One story revolved around relationships between three sisters and their parental family (Maayka), and the other story on relationships and life journey of two women friends from different class and caste backgrounds (Do Saheliyaan).

3.2.5 Channel wise summary of themes in content

To summarize, it can be said that, out of a total of 182 family based teleserials, there were a total of 87 teleserials with gender issues, themes or stories on life of women protagonists across four popular channels under study. Channel wise, out of a total of 87 gender centric teleserials, 50 teleserials i.e. 57% were contributed by Starplus and Colors together; and 71 teleserials i.e. 81% were contributed by Starplus and Colors and Zee TV together.

Table-23 Channel wise Thematic breakup of Gender centric teleserials

<table>
<thead>
<tr>
<th>Channel name</th>
<th>Total gender centric</th>
<th>Issue based teleserials</th>
<th>Issue related to marriage</th>
<th>Issue related to gender based discrimination</th>
<th>Issue related to gender based violence</th>
<th>Others issues</th>
<th>Issue based teleserial</th>
<th>Total</th>
<th>Challenging life journey of women</th>
<th>Women centric relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starplus</td>
<td>28</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>02</td>
<td>02</td>
<td>16</td>
<td>08</td>
<td>04</td>
<td></td>
</tr>
</tbody>
</table>
The 87 gender centric teleserials included 47 teleserials around issues related to women and gender as the primary theme, 31 teleserials around the challenging life journey of women protagonists under in a diversity of difficult situation and 11 teleserials around gender and relationships of women under specific circumstances.

It is important to mention that the 31 stories on challenging life journey of women had emphasis on the women protagonists and their tough situations, their self development, contributions to family and society in some way as the primary theme. In these stories the journey of women in addressing the challenges and facing them, the process was given the primary focus in the stories.

The stories on gender and relationships focused largely on relationships of women with respect to gender roles. These stories were focusing on the relationship aspect and challenges of women.

Many teleserials because of their overlapping content related to gender and women were classifiable into more than one category like discrimination, violence, empowerment etc. However, the classification has been undertaken and presented based on the basic primary theme and plot of the stories in teleserials.

Gender issues- Out of a total of 47 issue based teleserials, 32 teleserials had marriage and its related dimensions and challenges with respect to gender and women as the primary theme. Three teleserials focused purely on the issue of discrimination, and four teleserials focused purely on the issue of gender based violence as the primary theme; and eight teleserials focused on a variety of other gender issues as the primary theme.

Starplus and colors together accounted for 30 teleserials i.e. 63% of the total number of teleserials on gender issues as the primary theme. Also Starplus, Colors TV and Zee TV together contributed 40 teleserials i.e. 85% of the total issue based teleserials.

In the category of teleserials on challenging life journey of women, 80% of the teleserials i.e. 25 teleserials were contributed by Starplus, Zee TV and Sony TV together. In the category of gender and relationships, out of a total of 11 teleserials, 08 teleserials i.e. 72% were contributed by Starplus and Colors together.

4. Summary and conclusion

The birth of Colors TV and Balika Vadhu in 2008, the unending length of K serials (Kyunki…, Kahaani…, kausati….) and their unrealistic content led to a change in the emphasis of the content in Hindi language family based teleserials. A study of primary themes of 182 Hindi language family based teleserials across four popular channels i.e. Starplus, Colors, Zee TV and Sony TV was conducted over the time period 2008-2016 by visiting the teleserials on YouTube and channel websites together.

The study revealed that out of a total of 182 family based teleserials on these channels, there were 87 teleserials focusing on either women protagonists or issues related to gender and women. Interestingly, gender centric teleserials accounted for 46% of the total number of family based teleserials on the four channels.

Among the 87 gender centric teleserials, 47 teleserials focused on some gender issue as the primary theme, 31 teleserials focused on challenging life journey of women protagonists and their contributions to family and society in some way. 11 out of 87 teleserials focused on gender roles and relationships of women as the primary theme.

Among the 47 teleserials on gender issue as primary theme, 32 teleserials focused on issues related to marriage, 04 teleserials focused on gender based violence as primary theme, 03 teleserials focused on gender based discrimination as primary theme; and 08
teleserials focused on other gender issues as their primary theme. There were 31 teleserials focusing on challenging life journey of women, there self development, dreams and life goals. 11 teleserials focused on gender and relationships as their primary theme.

Channel wise, Starplus, Colors TV and Zee TV together contributed 40 teleserials i.e. 85% of the total issue based teleserials.

In the category of teleserials on challenging life journey of women, 80% of the teleserials i.e. 25 teleserials were contributed by Starplus, Zee TV and Sony TV together.

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ENERGY BALANCING TECHNIQUES FOR MAXIMIZING NETWORKS LIFETIME IN WIRELESS SENSOR NETWORKS

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Abstract— In Different physical environment, for examples sensor are placed in tunnels, bridges and forest areas there is an problem in energy draining since there is an difficult to replace the battery at each time networks lifetime is dependent when battery power gets decreased ,the network lifetime will be increased. To improve a networks lifetime three constraints are too been considered with coverage, connectivity and cardinality constraints. The energy can be saved by introducing clustering techniques individual nodes requires an more energy consumption rather than clustering .The cluster head can be selected based on the energy level with the small coverage range and activating an clustering head based on energy level and using particle swarm optimization algorithm and using greedy based algorithm for compressive sensing which can reduce the energy level while communicating source to sink node. Performance metrics can be analyzed, energy is balanced 35% when compared to the existing work.

Keywords— wireless sensor networks, connectivity constrains, cardinality constraints, clustering techniques, particle swarm optimization technique

INTRODUCTION

A wireless sensor network (WSN) is a self-organized wireless network gadget inclusive of a number of sensors, which accumulate data from their surrounding environments and transmit it to a statistics sink or a base station (BS) [1]. In WSN packages, the principle goal is to screen and acquire sensor facts after which transmit the facts to the BS. Sensors in different regions of the field can collaborate in data collection, and provide greater correct reviews approximately their neighborhood regions.

Most deployed WSNs measure physical phenomena like temperature, pressure, humidity, or area of items [2], to improve the fidelity of said measurements, and data aggregation reduces the communications overhead in the network, main to significant electricity savings [3], [4]. In wireless communications, sensor nodes are deployed .There is a dependent function when network lifetime is increased, the energy should be decreased. Still there is an issues while solving an energy problem. In direct source to sink communication without relay node it takes huge amount of energy. To reduce energy there should been introduced a new concept called Relay node. The main benefits of Relay node is transfer the data from one node to other node with lesser energy.

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The estimations of dense sensor networks are profoundly corresponded. Along these lines, we may draw out system lifetime significantly by presenting just a little misfortune in checking exactness [9]. Thusly, in this paper, we expand upon our earlier work [10] to devise a CS based initiation conspire that significantly decreases the quantity of sensor hubs to be enacted with the target of diminishing the vitality utilization and adjusting the leftover vitality of the sensor hubs. Specifically, vitality adjusting can accomplish the targets of greatest lifetime and power to sensor hub disappointments. As pipelines are found underground and thus battery substitution isn't simple, these destinations are of most extreme significance in water Distribution networks.

Considered a sensor are placed in dense area networks, the benefits are robustness, better utilization, less energy consumption. In dense area networks the cost is too high for installation and maintenance when an energy of sensor node is quickly drained out. For giving better improved performance in energy, the data compression techniques is been used.

Data Compression can been used in Data Gathering process to prolong the networks lifetime. Even though there is an individual node activation problem, there is a Sleep/Awake mechanism is introduced to save the energy which has been quickly drained out. To save more energy the clustering mechanism are used with an AODV protocol.

In thick sensor systems, excess sensor nodes are sent to represent the disappointment of individual sensor nodes. For this situation, not all sensor nodes must be dynamic to screen, and henceforth scheduling the sleep and activation periods of sensor nodes can give significant vitality benefits. For example, in sensor scope issues, such components are utilized to augment arrange lifetime while ensuring that all target demands are covered [20].

The clustering strategies procedure is precious in diminishing pressure usage in directing conventions [17]. In a clustering strategies layout, sensor hubs are composed into organizations, wherein the sensor hubs with bring down energy can be applied to perform detecting errands, and send the detected statistics to their bunch head at a quick separation [18].

A hub in a set may be taken as the cluster head (CH) to wipe out associated statistics from the members from the group, with the goal of diminishing the measure of the total information transmitted to the BS [18], [16]. A node in a cluster can be chosen because the cluster head (CH) to remove correlated information from the members of the cluster, with the goal of decreasing the quantity of the aggregated information transmitted to the BS [22], [23].

The clustering strategies method can build organize existence span and to enhance vitality productivity by restricting standard power utilization and adjusting vitality utilization a number of the hubs amid the device lifetime [16], [18]. In addition, it is equipped for easing channel dispute and package crashes, bringing approximately better system throughput under high load [18], [12].

II. LITERATURE SURVEY

A LIFETIME MAXIMIZATION BY FLOW OF DATA IN WIRELESS SENSOR NETWORKS

The lifetime of a framework phenomenally depends upon the waiting essentialness of the sharing center features. There are specific items for the noteworthyness use of sensor focal point focuses. In the centrality utilize is straightly recognized with the tolerant power, transmitting force and know-how transmission expense, and the customary lifetime of a sensor center of attention factor is depicted because the degree of the vitality uttermost scopes of the inside and the run of the mill essentialness use. In [9], the significance makes use of the middle focuses in relaxation mode are permitted to be zero, we arrange the vitality utilization of the dynamic sensor center of attention focuses to 1 and set that of the within focuses in relaxation mode proportionate. Within the value utilize is straightly identified with the tolerant power, transmitting drive and knowledge transmission rate, and the traditional lifetime of a sensor focus is depicted as the degree of the hugeness farthest reaches of the middle point and the general centrality utilization. When it is 0 it turns to be sleep state, when it turns been on state

In the first work [15], the essentialness use of the framework has been exhibited as a factor of the movement stream directing selections. By using then the difficulty is given an element as a straight programming hindrance.

In an identical framework environment, the place every sensor core point can both transmit its information to its neighbor with low imperativeness price, or transmit knowledge direct to the sink node with high energy cost, maximizing network lifetime is equivalent to flow extension and imperativeness enhancing [16]. In such circumstance, essentialness changing has been used to develop mastermind lifetime [17], [18].

The energy consumption of the network has been modelled as a function of the traffic flow routing decisions. Then the problem is cast as a linear programming problem. In a similar network setting, where every sensor node can either transmit its data to its neighbor with low energy cost, or transmit data directly to the sink node with high energy cost, maximizing network lifetime is equivalent to flow maximization and energy balancing [16].

In such scenario, energy balancing has been used to maximize network lifetime [27], [28]. Another way to balance the energy consumption is rotating the working period of sensor nodes, i.e., allowing some sensor nodes to sleep without sacrificing in the monitoring performance. For instance, Misra et. al. [29] have
considered finding different connected dominating sets of the WSN to prolong network lifetime. In each timeslot, only the sensor nodes in the connected dominating set are active and the other nodes are put into sleep. To rotate the working period of the nodes, it is desired to find the maximum connected dominating partition, which divides the WSN into as many as possible disjoint connected dominating sets. A similar problem has been considered in [18], where the sensor nodes have the energy harvesting ability.

Rongu Du (2015) proposed an extra vitality investment funds can be accomplished through Compressed Sensing-based booking plans that exact just a set number of sensors to detect and transmit their estimations, though the rest are killed. A definitive target is to boost organize lifetime without yielding system network and observing execution. This issue can be approximated by a vitality adjusting approach that comprises of different easier sub issues, every one of which relates to a particular day and age. At that point, the sensors that ought to be initiated inside a given period can be ideally determined through dynamic programming. The many-sided quality of the proposed Compressed Sensing-based planning plan is portrayed and numerical assessment uncovers that it accomplishes tantamount observing execution by actuating just a small amount of the sensors.

C. CLUSTERING TECHNIQUES

Nodes are classified into the CHs, Relay node (RNs) and cluster node(CNs). The activity of the convention incorporates two stages, i.e., the grouping setup stage and information transmission stage. The two stages are performed in each round of the system activity and rehashed occasionally. In the grouping setup stage, the cluster head, CHs and RNs and also the way between each group and the sink (or the BS) are resolved, and after that the system is sorted out. In the information transmission stage, the CHs gather information from all the group individuals and exchange to the transfer hubs which at that point hand-off the information to the BS as indicated by the topology determined

Leu J S, Chiang T H, Yu M C, & Su K W. (2015) proposed a new regional energy aware clustering method using isolated nodes for WSNs, called Regional Energy Aware Clustering with Isolated Nodes (REAC-IN). In REAC-IN, CHs were selected based on weight. Weight is determined according to the residual energy of each sensor and the regional average energy of all sensors in each cluster. Improperly designed distributed clustering algorithms can cause nodes to become isolated from CHs. Such isolated nodes communicate with the sink by consuming excess amount of energy. To prolong network lifetime, the regional average energy and the distance between sensors and the sink are used to determine whether the isolated node sends its data to a CH node in the previous round or to the sink.

Gherbi C, Aliouat Z, & Benmohammed M. (2016) proposed to combine these two valuable approaches in order to significantly improve the main WSN service such as information routing, which load traffic was shared among cluster members in order to reduce the dropping probability due to queue overflow at some nodes. To this end, a novel hierarchical approach, called Hierarchical Energy-Balancing Multipath routing protocol for Wireless Sensor Networks (HEBM) was proposed. The HEBM approach aims to fulfill the following purposes: decreasing the overall network energy consumption, balancing the energy dissipation among the sensor nodes and as direct consequence: extending the lifetime of the network. In fact, the cluster-heads were optimally determined and suitably distributed over the area of interest allowing the member nodes reaching them with adequate energy dissipation and appropriate load balancing utilization. In addition, nodes radio were turned off for fixed time duration according to sleeping control rules optimizing so their energy consumption.

D. PROBLEM FORMULATION
In WSN, there is a draining of energy problem when the sensor nodes are placed in tunnels, bridges and dense area Networks etc.… the other issue is Activate the sensor node based on the energy level with Neighbour nodes and there is no optimized path .to improve the path and energy level introducing clustering technique with improved PSO algorithm with cardinality constrains makes the less utilization of energy

III. EXISTING WORK

A. CONNECTIVITY CONSTRAINTS

Let twofold factor xi(t) show whether node vi is dynamic at timeslot t.

At that point, the vitality elements of vi can be composed as 

\[ E_i(t + 1) = E_i(t) \times i(t) \]

and the scheduling problem considered in this paper is to determine \( x(t) = [x_1(t),...,x_N(t)]^T \), a chance to mean the prompted chart of dynamic sensor hubs and the sink hubs.

Definition 1: (Availability Imperative) The actuation of the sensor hubs \( x(t) \) fulfills the network limitation if and just if the prompted chart \( G(x(t)) \) is associated.

Definition 2: (Cardinality Imperative) The initiation of the sensor hubs \( x(t) \) fulfills the cardinality limitation if \( P \) furthermore, just if \( x_i(t) = \max \{M_{cs},M_c\} \), where \( M_{cs} \) is controlled by the required estimation mistake of the deliberate information.

At that point, the lifetime augmentation issue can be defined as an ideal control issue as takes after:

\[
\max \sum_{i \in V} x_i p_i \\
\text{s.t.} \sum_{i \in V} x_i = \max \{M_{cs},M_c\} \ G(x) \text{ is connected,} \\
X_i \in \{0,1\}, \forall i \in V
\]

Definition 3: (Activation Profile) A sanctioning profile is a social affair of sensor center points that satisfies the accessibility necessity.

C. ENERGY BALANCING PROBLEM

The crucial properties of the vitality adjusting issue from the perspective of system lifetime expansion, we give the essential points of interest in the accompanying

\[ p(t) = E_i(t)/E_i \text{ In [14], we built up a calculation to take care of Issue (4). The points of interest of the methodology are appeared in Calculation 1. To begin with, Calculation 1 discovers } M_c \text{ for example, Dijkstra's calculation in Line 1, to be specific finds the most limited way from } v_0 \text{ to } v_{N+1}, \text{ where the weights of the considerable number of edges are 1. At that point, the base number of sensor hubs, } m, \text{ that fulfills both the availability and the cardinality requirements.}

ALGORITHM 1

\text{INPUT} : Adjacency matrix A, the minimum number of active node battery of the nodes } M_{cs}, \text{ the battery of the nodes } E_i, \forall i.

\text{OUTPUT} : Network lifetime

\text{PROCEDURE}

1. Set } t \leftarrow 1, \text{ Flag } \leftarrow \text{ TRUE, } E_i(t) = E_i
2. while Flag do
3. \quad Set } p_i \leftarrow E_i(t)/E_i, \ p = \{p_1,\ldots,p_n\}
4. \quad Find } M_c \text{ for the connectivity constraint}
5. \quad VA \leftarrow \text{Call Algorithm 1 with input } A,M_{cs},p
6. \quad if } VA \neq \emptyset \text{ then}
7. \quad \quad Set } t \leftarrow t + 1, \ E_j(t) \leftarrow E_j(t-1)-1, \forall j \in V
8. \quad Else
9. \quad \quad Set Flag \leftarrow \text{FALSE}
10. \quad end if
11. \quad end while
12. \quad return } T \leftarrow t-1

IV. PROPOSED WORK

Node are arranged into the CHs, transfer Relay node (RNs) and Cluster Nodes (CNs). The operation of the convention incorporates two stages, i.e., the grouping setup stage and information transmission stage. The two stages are performed in each round of the system operation and rehashed intermittently. In the Clustering setup stage, the groups, CHs and RNs and additionally the way between each bunch and the sink (or the BS) are resolved, and afterward the system is sorted out. In the information transmission stage, the CHs gather information from all the group individuals and exchange to the transfer nodes which then relay the data to the BS according to the topology determined in the phase with the coverage range

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At the beginning, each node sends a Node-MSG message to broadcast its residual energy information. The BS chooses the bunch heads by utilizing the calculation and communicate a message including the group heads' ID to educate the system of the group head's area. After the group heads know their status, each bunch head acquaints itself with the system by communicating a little commercial message (i.e., CH-ADV), which utilizes the non-tireless bearer sense various access (CSMA) MAC convention. The message incorporates the group head's ID and a header that distinguishes it as an ad message. Then, also, the BS select the hand-off hub by utilizing the calculation, Once a transfer hub is chosen, a notice message (i.e., RN-ADV), which incorporates its ID, the comparing group head's ID and the header, is sent to the system by the BS to announce its status as a hand-off hub. Every basic hub chooses its group by picking the bunch head that requires the base transmission vitality, in light of the quality of the CH-ADV message from each bunch head. At that point, a group is picked; after every normal hub has chosen which bunch it participate, it must educate the group leader of its choice by transmitting a JOIN-REQ message. The message is again short, comprising of the hub's ID, the having a place group head's ID and the sender's leftover vitality.

The Cluster head sets up a TDMA scheduler and communicates the SCHEDULE-MSG message to the regular hubs in the group and also the relating transfer hub. This maintains a strategic distance from impacts among information messages, and furthermore permits the radio segments of every normal hub and transfer hub to be turned off constantly, with the exception of when the regular hubs transmit messages or hand-off hubs get messages.

**IMPROVED PARTICLE SWARM OPTIMIZATION TECHNIQUE**

Owing to its simple idea and high efficiency, PSO has grow to be a widely followed optimization approach and has been efficiently implemented to many actual-international troubles. In our preceding work, we use PSO set of rules to solve software program-described community troubles efficaciously [15]. However, PSO plays poorly in phrases of nearby search with premature convergence, particularly for complicated multi-peak search problems [15], [16]. In order to deal with this particular situation, we improved the traditional PSO algorithm by using adjusting the inertial weight to avoid particles being trapped in neighborhood optima, and used the stepped forward PSO set of rules to maximize the fitness capabilities of (five) and (eight). The technique consists of the following 5 fundamental steps:

- Initialize the optimization problem and algorithm parameters.
- Calculate the fitness values
- Update velocity and position vectors
- Change the inertial weight.
- Go to step 3 until the termination criterion is met

\[ vt+1 = vt + r1c1(p - x) + r2c2(g - x) \]
\[ xt+1 = xt + vt+1 \]

**CARDINALITY CONSTRAINTS**

After applying a Genetic algorithm there will be an optimized path with the connectivity. The energy level of two sensor Nodes can been sum up by single node. The energy are balanced by applying Greedy Based Algorithm, While choose the sensor node based on Maximum energy level with Minimum distance.

**V. RESULTS AND DISCUSSION**

The performance of Qos is analyzed by implementing connectivity and cardinality constraints with energy balancing. The result shows that Qos performance is improved 35%. The following parameters taken into account for Qos performance are:

- Packet Loss Rate
- Delay
- Energy
VI CONCLUSION

In work proposed an imperativeness modifying methodology in light of perfect authorization logbook and start in perspective of essentialness altering figuring and compressive distinguishing. Authorizing particular sensor favorable circumstances to the framework field. It lessens the imperativeness. By then the coordinating method used is clear and fiery. An institution of particular sensor system is exhibited which reduces the imperativeness. These segments achieved an ok execution in the framework. Some of parameters are used for propagation. They are throughput, package transport extent, and total residual imperative characteristic and so forth. These parameters are evaluated with different regards for the execution examination.

In existing technique there is an essentialness altering strategy in light of the figuring and compressive identifying. It uses the gainful imperative characteristic when outline with the other computation. Still there is an open issues in essentialness altering.

VII FUTURE WORK

In existing system there is an problem in energy even though applying Particle Swarm Optimization Algorithm still there is an Open issue

The issue can be overcome with using various algorithms by applying in hybrid clustering techniques with different Protocols and hierarchal compressive sensing with various algorithm to improve more lifetime by balancing energy

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A SWOT Analysis of Landfill Management System: Case Study of Talangagung Edu-tourism Landfill in Malang, East Java

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Abstract- The educational tourism landfill management system was one way that could be applied by the landfill manager to support environment based waste management program and environmental conservation education. This study aimed to determine the status quo of Talangagung educational tourism (edu-tourism) landfill, at Kepanjen, Malang as one landfill model of national pilot that had implemented controlled landfill management system in Indonesia. This research used qualitative approach by using SWOT and IFAS-EFAS analysis. SWOT and IFAS-EFAS analysis used to evaluate internal (strengths, weaknesses) and external (opportunities and threats) factors regarding landfill management policy as an edu-tourism landfill. Talangagung landfill has strength and opportunities which could be utilized for further policy development. Currently, the Talangagung landfill position was in growth quadrant based on SWOT and IFAS-EFAS analysis. The appropriate management policy strategy for the current Talangagung landfill condition was to utilizing and synergizing maximally the strengths and opportunities available to achieve better management. The policy could be selected to support further development of landfill was to strengthen social relationships with surrounding communities and visitors.

Key words- edu-tourism, landfill, waste management, SWOT

I. INTRODUCTION

As one of the developing countries, municipal waste management is still a problem that has not been resolved to date in Indonesia [1], [2], [3], [4]. The increase in the amount of waste generated continues to occur as a result of the increase in human population, daily needs and the economy sector development. So far, landfill management system in Indonesia mostly still apply open dumping system, so it tends to have negative impact to the surrounding environment such as soil, water and air contamination, odors, disease vector, etc [3], [5], [7]. The negative impacts caused the existence of landfill is still not desirable or acceptable even rejected by the community. Effect of waste can bring bad impact to the community if the waste is stacked in the absence of proper management. In addition to the development of waste processing technology, the government and related institutions must continue to build public awareness that waste reduction is everyone's duty [6]. The development of cities in Indonesia is generally uneven, so the environmental problems that arise are also different. Cities with high population growth rates will create environmental problems that are different from cities with low population growth rates [7].

Since the enactment of Law no. 18 of 2008 on waste management by the Government of Indonesia, the landfill that still apply the open dumping system must switch to controlled landfills, minimally. In this law, waste management should pay attention to the principle of reduce, reuse, and recycle (3R) [8]. In addition, waste management in the landfill should be carried out in an environmentally sound manner to avoid adverse impacts on the community and the environment itself [1], [9]. There are several factors that affect waste management practices in developing countries, such as Indonesia. These factors include the composition and amount of waste, access to waste collection site, community awareness levels, and government policies / regulations [10], [11], [12].

Waste processing is an attempt to reduce the volume of waste or change its form becomes more useful. Collected waste can be processed further, either at the location of waste sources and after arriving at landfill as final waste processing site [13]. Improper waste management can lead conflicts between the landfill managers and the surrounding communities [12]. So, how to make the existence of landfill can be accepted by the community still have to look for the solution until now. One alternative solution that can be offered is through the engineering of landfill management systems. The applied landfill management system must provide benefits not only to the environment but also community so that the existence of landfill can be sustainable for a long time.

Talangagung edu-tourism landfill, located in Kepanjen, Malang Regency is an open dumping landfill which is converted into controlled landfill nowadays. The construction of the Talangagung landfill began in September 2009, and in 2010 this landfill was developed into a prototype model for the utilization of methane gas as a product of waste management process. In January 2011, landfill improvements were conducted based on the results of discussions with experts from some local
The current condition of Talangagung landfill serves 17 sub-districts in administrative area of Malang regency with the population reach 1,258,112 people in an area of 1313.13 km². Served landfill area are consisted of three technical unit areas (UPT) namely UPT Kepanjen, UPT Turen, and UPT Bululawang. The volume of input garbage at Talangagung landfill continuously increase. This is evidenced by the increase in garbage volume data doubled in from 2009 to 2016. In 2009, garbage input to this landfill was 114.7 m³/day then it reached to 239.4 m³/day in 2016. Due to the significant increase of waste input, if the Talangagung landfill is not managed properly then it will have negative impact on the environment around and it also will affect the occurrence of social conflict with community surrounding.

Talangagung landfill is developed as educational tourist destination and applied laboratory of appropriate technology for waste management. Moreover, this landfill was also developed as a learning place to improve student’s motivation and community awareness on environment conservation aspect. Educational tourism (edu-tourism) is a program where tourists visit a tourist destination with the main purpose to gain direct learning experience in the tourism object [15], [19]. Educational tourism is a tourism concept that implements nonformal education about new knowledge to tourists visiting a tourism object [16].

This study aimed to determine the status quo of Talangagung landfill as an educational tourism landfill in Malang regency. In order to achieve these objective, the SWOT analysis was used as a tool to identify internal and external factors that affect waste management of the landfill. Furthermore, these factors will be used to determine better management policies in the future through the formulation of strategic action plan. SWOT is an analytical tool designed to be used as preliminary stages of decision making on the one hand and as prior in planning management strategies on the other. According to Saaty [17], the SWOT analysis is used to maximize both strengths and opportunities, minimize external threats, turn weaknesses into strengths and take advantage of existing opportunities as long as it still minimize internal weakness and external threats.

II. RESEARCH METHOD

A. Study Area

This research was conducted in Talangagung village, Kepanjen Subdistrict, Malang Regency, East Java Province, precisely at Talangagung edu-tourism landfill. Determining the location of research was carried out intentionally, with consideration as follows (1) Talangagung landfill was the main priority program of the Malang Government in order to follow up the Government of Indonesia Act No. 18 of 2008 on Waste Management; (2) Talangagung landfill had been identified as Smart Practice 2016 by Knowledge Center, Ministry of National Development Planning of the Republic of Indonesia (BAPPENAS).

B. Data Collecting

This study used a qualitative approach through field observation, questionnaires, and structured interviews. Interview is a process of obtaining information for the purpose of research through question and answer while holding face to face between the interviewer with respondent or person interviewed, with or without using interview guidelines. Communities living around the landfill, landfill managers and visitors are used as respondents in this study. Communities and visitors were randomly selected when data collecting process. There are two stages of the activities carried out in the data collecting of this study. The first step was to identify relevant internal and external factors based on the results of the social survey that had been performed. Internal factor analysis was a comprehensive evaluation of the ‘internal environment’ in the form of strengths and weaknesses, while external factors include opportunities and threats that might arise. The second step was formulation of strategic action plan in landfill management based on internal and external factor analysis.

C. Data Analysis

The analysis used in determining the Talangagung landfill management policy was SWOT and IFAS-EFAS analysis. SWOT analysis was one form of analysis that could be used to interpret a plan under complex conditions. Internal and external factors in this analysis had an equally important role. SWOT analysis was an analysis to evaluate factors affecting landfill management, the factors included Strength, Weakness, Opportunity and Threats, then inventory those factors in the planning strategy used as the basis for determining policy in further landfill management. Given these linkages, there would be some basic strategies or concepts that could be used in determining appropriate management strategy Talangagung landfill.

The determination of Talangagung landfill management strategy was based on SWOT analysis by weighting using IFAS-EFAS technique. Then the factor weighting result was presented in quadrant form which would determine current position of
Talangagung landfill and type of strategy to be developed. Weighting technique was carried out on every aspect/factors of SWOT by assigning a weight between 0.00 and 1.00. If the aspect on each factor (internal / external) summed would result 1. After weighting, rating was given. This rating indicated importance level each aspect (1 = somewhat important; 2 = important; 3 = very important). Then, the weighted score was multiplied by a predetermined rating. The sum of each factor then summed in order to know position of landfill location in the SWOT quadrant for determining policy strategy of landfill management [12], [18].

### III. RESULTS

SWOT analysis for evaluated on waste management of Talangagung landfill could help to understand the internal and external conditions in this landfill. This was useful as a preliminary information in developing landfill management strategies. Identified SWOT from interviews, questionnaires distribution, and field observations were presented in Table 1 below.

<table>
<thead>
<tr>
<th>Internal Factors</th>
<th>External Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
<td></td>
</tr>
<tr>
<td>S1. Good waste management system (controlled landfill)</td>
<td>Opportunities</td>
</tr>
<tr>
<td>S2. Existence of integrated methane gas purification system</td>
<td>O1. Local government supporting for landfill improvement</td>
</tr>
<tr>
<td>S3. Availability of basic, supporting, and environmental protection facilities for community and visitors</td>
<td>O2. Active participation from surrounding community</td>
</tr>
<tr>
<td>S4. The existence of independent community groups</td>
<td>O3. High interest of public community to educational tourism</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weaknesses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>W1. Some operational facilities are not quite adequate such as bulldozers and wheel loaders</td>
<td></td>
</tr>
<tr>
<td>W2. Some poor quality of operational human resources</td>
<td></td>
</tr>
<tr>
<td>W3. Decreasing in landfill area</td>
<td></td>
</tr>
<tr>
<td>W4. The evaluation of landfill management has not involved independent consultant</td>
<td></td>
</tr>
</tbody>
</table>

Based on previous internal factor analysis (strength and weakness), IFAS matrix could be obtained, Table 2. IFAS analysis was especially conducted on identified internal factors in Talangagung landfill. In this analysis, weighting of identified internal factors was performed. The results showed that strength factor had a higher value than weakness factor. Similar to the IFAS matrix, EFAS matrix analysis was also performed in the same way. For EFAS analysis, the external factors studied were opportunities and threats toward Talangagung landfill management system, Table 3.

### Table 2. IFAS scoring on identified internal factors of Talangagung landfill

<table>
<thead>
<tr>
<th>Internal Factors</th>
<th>Weigh</th>
<th>Rating</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strengths</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1. Good waste management system (controlled landfill)</td>
<td>0.15</td>
<td>3</td>
<td>0.45</td>
</tr>
<tr>
<td>S2. Existence of integrated methane gas purification system</td>
<td>0.14</td>
<td>3</td>
<td>0.42</td>
</tr>
<tr>
<td>S3. Availability of basic, supporting, and environmental protection facilities for community and visitors</td>
<td>0.12</td>
<td>3</td>
<td>0.36</td>
</tr>
<tr>
<td>S4. The existence of independent community groups</td>
<td>0.09</td>
<td>2</td>
<td>0.18</td>
</tr>
</tbody>
</table>

**Total** | 0.5 | 1.41 |

<table>
<thead>
<tr>
<th><strong>Weaknesses</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>W1. Some operational facilities are not quite adequate such as bulldozers and wheel loaders</td>
<td>0.12</td>
<td>3</td>
<td>0.36</td>
</tr>
<tr>
<td>W2. Some poor quality of operational human resources</td>
<td>0.16</td>
<td>3</td>
<td>0.48</td>
</tr>
<tr>
<td>W3. Decreasing in landfill area</td>
<td>0.14</td>
<td>2</td>
<td>0.28</td>
</tr>
<tr>
<td>W4. The evaluation of landfill management has not involved independent consultant</td>
<td>0.08</td>
<td>2</td>
<td>0.16</td>
</tr>
</tbody>
</table>

**Total** | 0.5 | 1.28 |

### Table 3. EFAS scoring on identified external factors of Talangagung landfill

<table>
<thead>
<tr>
<th>External Factors</th>
<th>Weigh</th>
<th>Rating</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opportunities</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O1. Local government supporting for landfill improvement</td>
<td>0.1</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>O2. Active participation from surrounding community</td>
<td>0.15</td>
<td>3</td>
<td>0.45</td>
</tr>
<tr>
<td>O3. High interest of public community to educational tourism</td>
<td>0.25</td>
<td>3</td>
<td>0.75</td>
</tr>
</tbody>
</table>

**Total** | 0.5 | 1.4 |

<table>
<thead>
<tr>
<th><strong>Threats</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>T1. Increase of input waste amount to landfill</td>
<td>0.2</td>
<td>2</td>
<td>0.4</td>
</tr>
<tr>
<td>T2. Low budget or financial support for operational facilities</td>
<td>0.3</td>
<td>3</td>
<td>0.9</td>
</tr>
</tbody>
</table>

**Total** | 0.5 | 1.3 |

Talangagung landfill position in the IFAS-EFAS quadrant was determined by calculating values on the x-axis (abscissa) and y-axis (ordinate) referred to the total value of each factor. Based on the calculations with IFAS and EFAS score above, it could be seen the value of X and Y as follows:

\[
X = \text{Strength} + \text{Weakness} = 1.41 + (-1.28) = 0.13
\]

\[
Y = \text{Opportunity} + \text{Threat} = 1.41 + (-1.3) = 0.11
\]

Based on the mapping of strengths, weaknesses, opportunities, and threats identified in Talangagung landfill waste management, landfill position was obtained in IFAS-EFAS quadrant. Currently, Talangagung landfill was in quadrant I which was the growth quadrant. Quadrant I showed a situation or condition that was very good because there were strength that could be utilized to seize a profitable opportunity. The strategy that could be applied to this condition was to support a progressive growth policy. This mean that Talangagung landfill was in prime condition and steady so it was possible to continuously grow and achieve maximum progress. The
A description of quadrant of Talangagung landfill management policy from EFAS IFAS matrix was shown as in Figure 2 below.

![Quadrant position of Talangagung landfill based on IFAS-EFAS analysis](image)

In this position, Talangagung landfill can develop by maximizing the potential strength and opportunities already exist. Development of policy strategy for better landfill management should take into account any strengths owned and then combined with open opportunities. Indeed, the Talangagung landfill management has been very well proven by the status of a national pilot landfill that can be adopted by other landfills in Indonesia. However, the current management needs to be improved so that the service and waste processing activities could be performed better.

Development of policy be applied to further management of Talangagung landfill refered to SWOT analysis result. It was shown on Table 3. The strategies developed refered to identified strengths, weaknesses, opportunities, and threats factors. The principles used in SWOT analysis to achieve core strategy include [9], [10]:

- a. Utilization of existing strength and opportunities openly
- b. Strategies that address existing threats
- c. Strategies that fix existing weaknesses

In context of Talangagung landfill management as an educational tourism destination, SWOT analysis was used to determine policy strategy in order to improve existing landfill management system. The results of this analysis could help in mapping the current conditions of landfill so that it was useful in anticipating the possibility of problems that arise in the future [6], [9].

The management policies implemented at Talangagung landfill was in line with the national policy on waste management. The implemented policies should comprehensively cover or relate to many agencies with reference to the RPJMD policy. In addition, the policy of Talangagung landfill was also in line with the vision of the Malang Government “Madep Mantep Manetep” with the community, with three main strategies including (1) reducing the poverty rate; (2) optimization of tourism sector; (3) environmental sustainability.

To support growth or development in improving landfill management in the future, then the policy strategies that need to be implemented include:

1. Exemption of use of methane gas costs by communities around the landfill. As known, Talangagung landfill had developed a system of utilization of methane gas as a result of waste processing activities and it integrated to community around the landfill, in their house. Since implementation of this technology, many benefits were felt by the community and landfill managers. By applying policy to free up the cost of methane gas utilization, sense of community’s trust and ownership to existence landfill will also increase. Along with this, the relationship between community and landfill manager becomes better. Thus, the planned or implemented educational landfill management programs will gain support from the community as a reciprocity so that it can be well organized.

2. Increasing promotion of educational tourism in Talangagung landfill. As a landfill developed as an educational tourism destination, the existence of Talangagung landfill needs to be published massively to public. The use of mass media both of print or electronic need to be followed up with optimal. With the increasing number of visitors to Talangagung landfill, opportunity of conveying about the importance of environment-based waste management to public is also becoming greater. This is the main objective of development of Talangagung edu-tourism landfill. The process of environmental education to community need to be conducted with a rather different approach such as example of waste management practices that provide tangible benefits. This educational approach techniques can be more easily understood and acceptable by various society levels such as children, youth, adults, or low-educated citizens. Therefore, efforts to introduce educational tourism landfill by utilizing the mass media should be applied because currently access to news and information can be done very easily.

3. Improved service at landfill for the visitors. After conducting intensive promotion to public, the landfill management must also prepare themselves to provide the best service for visitors. The availability and functionality of supporting facilities waste management activities should be considered carefully. The existence of operational and supporting facilities on landfill management such as monitoring wells, leachate wells, and methane gas purification system can be a special attraction for visitors. By visiting this landfill, visitors are expected to understand the flow of waste management process in landfill well so that educational messages are delivered. The opposite will happen if the availability and functionality of such facilities are absent. This causes the educational process cannot be held successfully so that the potential for loss of information of educational message becomes high. Therefore, the existence of facilities both operational, supporting, environmental protection in Talangagung landfill is needed to support the educational landfill program.

IV. CONCLUSION

Waste management system at Talangagung educational Tourism landfill had been implemented well and based on environmental
conservation concept. In addition, the existence of this landfill had positive impacts on the surrounding community. This was showed by the technological innovation of methane gas purification system which then was integrated with surrounding residents' houses. The processing of waste practiced in this landfill became an attraction or educational tourism attraction for community and visitors related to environmental conservation practices. Currently, Talangagung landfill condition was in a growth stage based on results of SWOT and IFAS-EFAS analysis. The policy that could be selected to support further development of this landfill was to strengthen social relationships with surrounding communities and visitors through improving services and environmental conservation education practices.

ACKNOWLEDGMENT

The author would like to thank the Malang Regency Government, people's community in Talangagung, Talangagung landfill management, UB Rector, and Director of Graduate Program – Universitas Brawijaya.

REFERENCES

<table>
<thead>
<tr>
<th>EFAS IFAS</th>
<th>Strengths (S)</th>
<th>Weakness (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPPORTUNITIES (O)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO1. Utilization of methane gas is free of charge for the surrounding community</td>
<td><strong>SO Strategy</strong></td>
<td><strong>WO Strategy</strong></td>
</tr>
<tr>
<td>SO2. Increasing promotion of educational tourism landfill to wider community through various mass media, electronic or printed</td>
<td></td>
<td>WO1. Improving human resources competence through training and workshop about good landfill management</td>
</tr>
<tr>
<td>SO3. Improving services for landfill visitors in availability facilities and infrastructure</td>
<td></td>
<td>WO2. Collaboration with academics, practitioners (independent consultants) in conducting evaluation of landfill management</td>
</tr>
<tr>
<td><strong>THREATS (T)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ST1. Waste processing activities should be suited with planning</td>
<td><strong>ST Strategy</strong></td>
<td><strong>WT Strategy</strong></td>
</tr>
<tr>
<td>ST2. Regularly maintain of existing facilities in order to optimally provide benefits for a long time</td>
<td></td>
<td>WT1. Utilization of organic waste processing product to be additional income for landfill management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>WT2. Collaboration with other landfills in the processing of waste to prevent excessive accumulation</td>
</tr>
</tbody>
</table>
Effect of Corrosion Inhibitors Influence on Bond Behavior of reinforced concrete Structures Exposed to Corrosive Environment of Sodium Chloride (NaCl)

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3School of Engineering, Department of Civil Engineering, Kenule Beeson Saro-Wiwa Polytechnic, Bori, Rivers State, Nigeria.

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Abstract: Corrosion of reinforced concrete members generates tremendous tensile stress within the concrete surroundings, thereby cutting short expected design life span of structures. This experimental work investigated the influence of corrosion inhibitors of mangifera indica steel coated bar with resins / exudates on the bond behavior of reinforced concrete cube members. Cubes of 150 mm x150 mm x150 mm of uncoated and coated with mangifera indica resins/exudates extracts of thicknesses 150µm,(ABC), 250µm (DEF) and 350µm (GHI) were embedded into concrete and exposed to harsh marine saline / corrosive environment of Sodium Chloride (NaCl) for 60days to accelerate corrosion potential process. Results indicated corrosion potential possibility with evidences of cracks, pitting and spalling. Experimental results indicated increased in failure bond load, bond strength and maximum slip by 36.49%, 66.30% and 85.57% in coated specimens, increased by 27.08%, 55.90, 47.14% of non-corroded as against decreased by 21.30%, 36.80% and 32.00% in corroded specimens respectively. Entire results showed higher failure bond load in corroded as compared to non-corroded and coated members.

Key Words: Corrosion, Corrosion inhibitors, Pull-out Bond Strength, Concrete and Steel Reinforcement

1.0 INTRODUCTION

Corrosion generates tensile stresses in steel reinforcement surroundings in the concrete, resulting to early cracks. In addition, steel reinforcement cross sectional – area reduction is noticed thereby causing decreased in ductility of the structure, especially during the occurrence of corrosion pitting. An increase in the size of reinforcing steel bars such as expansion and volume is the result of rust products, it results to weakness of the reinforcing steel bar cross- sectional area as well reduces the rate of bonding between reinforcing steel bar and concrete thereby creating stress within the concrete surroundings, furthermore, cracking and spalling of concrete is noticed due to severe stress which reduces the reinforced concrete structures designed life and durability, (Almusallam et al. 1995, Cabrera 1996, Rashid et al. 2010).

Otunyo and Kennedy (2018) investigated the effectiveness of resin/exudates in corrosion prevention of reinforcement in reinforced concrete cubes. The reinforced concrete cubes of dimension (150mm x 150mm x 150mm) were coated with dacryodes edulis resin paste of various thicknesses: 150um, 250um, and 300um. The reinforced concrete cubes were exposed to a corrosive environment for 60days after 28 days of curing. Results obtained indicated that the failure bond strength, pull out bond strength and maximum slip of the resin coated reinforced cubes were higher by (19%), (84%) and (112%). respectively than those obtained from the controlled tests.

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Similar results were obtained for the maximum slip (the resin coated and non-corroded steel members) had higher values of maximum slip compared to the cubes that had corroded steel reinforcements. For the corroded beam members, the failure bond strength, pull out bond strength and maximum slip of the resin coated reinforcements were lower by (22%), (32%) and (32%), respectively than those obtained from the controlled tests.

Cusens and Yu (1992) studied the an epoxy coated reinforcing steel bars pull-out tests in concrete which involved the conduction of single pull-out and double control uncoated bars. The size of the test specimen was $250 \times 250 \times 410 \text{ mm}$ with 25mm bars and $150 \times 150 \times 200 \text{ mm}$ with 12mm bars in compliance with BS 4449. Single pull-out test results suggested loaded end of coated epoxy bars showed more as compared to non-coated reinforcing steel bars. The reinforcing bars were centrally embedded passing completely longitudinal axis.

Kayyali and Yeomans (1995) compared galvanized, black and epoxy-coated rebars were embedded in reinforced concrete beams of size $1500 \times 160 \times 320 \text{ mm}$ by evaluating the bond and slip of coated reinforcement in concrete. The test results revealed minimal bond strength loss from galvanized steel bars and as well as minimal reduction in the bond strength of coated epoxy reinforcing steel bars. Chung et al., (2004) studied the effect of corrosion on pullout bond strength and development length. Different level of corrosion were used to corrode the reinforcement, concrete slab specimens with one steel reinforcing bar were used to investigate the bond stress and length development on tension member in flexure. It was concluded that at 2% level of corrosion, increases and fails it reaches an average bond stress. Han-Seung Lee et al., (2002) evaluated the corrosion of reinforcing steel as function of degree of bond properties between concrete and reinforcement. They evaluated pull out bond test to ascertain the bond characteristics between concrete and corroded reinforcing steel bar. Pull-out tests were conducted on specimens with and without confinement reinforcement. Experimentally, results were obtained from load versus free end slip behavior was studied and the rigidity of bond for the analysis of Finite Element with corroded reinforcement in reinforced concrete members. Cairns and Plizzari (2003) affirmed that the split from concrete surrounding resulted from bearing action of ribs that generates bursting forces. Tensile capacity of the ring is exceeded during the development of the bond action, a splitting failure occurs by fracturing the concrete cover surrounding the reinforcement. If the concrete confinement was enough to counter balance the force generated by bond.

2.0 Experimental program

The present study involves direct application of resins / exudates of trees extract known as inorganic inhibitor, coated on the reinforcing steel surface were studied in this test program. The main objective of this study was to determine the effectiveness of locally available surface-applied corrosion inhibitors under severe corrosive environments and with chloride contamination. The test setup simulates a harsh marine environment of saline concentration in the concrete in the submerged portion of the test specimens, corrosion activity of the steel cannot be sustained in fully immersed samples. The samples were designed with sets of reinforced concrete cubes of $150 \text{ mm} \times 150 \text{ mm} \times 150 \text{ mm}$ with a single ribbed bar of 12 mm diameter embedded in the centre of the concrete cube specimens for pull out test and was investigated. To simulate the ideal corrosive environment, concrete samples were immersed in solutions (NaCl) and the depth of the solution was maintained.

2.1 MATERIALS FOR EXPERIMENT

2.1.1 Aggregates

The fine aggregate was gotten from the river, washed sand deposit, coarse aggregate was granite a crushed rock of 12 mm size and of high quality. Both aggregates met the requirements of BS 882.

2.1.2 Cement
The cement used was Eagle Portland Cement, it was used for all concrete mixes in this investigation. The cement met the requirements of BS EN 196-6

2.1.3 Water
The water samples were clean and free from impurities. The fresh water used was gotten from the tap at the Civil Engineering Department Laboratory, University of Uyo, Uyo. Akwa - Ibom State. The water met the requirements of BS 3148

2.1.4 Structural Steel Reinforcement
The reinforcements are gotten directly from the market in Port Harcourt.

2.1.5 Corrosion Inhibitors (Resins / Exudates) Mangifera indica
The study inhibitor (Mangifera indica) is of natural tree resin /exudate substance extracts. They are abundantly found in Rivers State bushes and they are sourced from plantations and bushes of Odioku communities, Ahoada West Local Government areas, Rivers State, from existed and previously formed and by tapping processes for newer ones.

2.2 EXPERIMENTAL PROCEDURES

2.2.1 Experimental method
2.2.2 Sample preparation for reinforcement with coated resin/exudate
Corrosion tests were performed on high yield steel (reinforcement) of 12 mm diameter with 550 mm lengths for cubes, Specimen surfaces roughness was treated with sandpaper / wire brush and specimens were cleaned with distilled water, washed by acetone and dried properly, then polished and coated with Mangifera indica resin pastes with coating thicknesses of 150µm, 250µm and 300µm before corrosion test. The test cubes and beams were cast in steel mould of size 150 mm × 150 mm × 150 mm. Fresh concrete mix for each batch was fully compacted by tamping rods, to remove trapped air, which can reduce the strength of the concrete and 12 mm reinforcements of coated and non-coated were spaced at 150 mm with concrete cover of 25 mm had been embedded inside the slab and projection of 100 mm for half cell potential measurement. Specimens were demoulded after 24hrs and cured for 28 days. The specimens were cured at room temperature in the curing tanks which then gave way for accelerated corrosion test process and testing procedure allowed for 39 days first crack noticed and a further 21 days making a total of 60 days for further observations on corrosion acceleration process.

2.3 Accelerated corrosion set-up and testing procedure
In real and natural conditions the development of reinforcement corrosion is very slow and can take years to be achieved; as a result of this phenomenon, laboratory studies necessitate an acceleration of corrosion process to achieve a short test period. After curing of beams and cubes specimens for 28 days, specimens were lifted and shifted to the corrosion tank to induce desired corrosion levels. Electrochemical corrosion technique was used to accelerate the corrosion of steel bars embedded in beams specimens. Specimens were partially immersed in a 5% NaCl solution for duration of 60 days, to examine the surface and mechanical properties of rebars.

2.3 Pull-out Bond Strength Test
The pull-out bond strength tests on the concrete cubes were performed out after 54 specimens on Universal Testing Machine of capacity 50KN in accordance with BS EN 12390-2. After curing for 28days, 6 controlled cubes (non-corroded) was kept in a control condition as against corrosion as to ascertain bond difference effects, 48 cubes samples of non-coated and resin / exudates coated were
partially place in ponding tank for 39 days placed to examine accelerated corrosion process. After 39 days, the accelerated corrosion subjected samples were examined to determine bond strength effects due to corrosion and corrosion inhibited samples.

The dimensions of the pull-out specimens were 54 cubes 150 mm × 150 mm × 150 mm with a single ribbed bar of 12mm diameter embedded in the centre of the concrete cube. The bond length of the bar was placed at the centre of the concrete cube with 40mm of length protruding from the top of the specimen and with the outer 75 mm of the reinforcing bar enclosed in a PVC tube to ensure that these sections remained un-bonded. Additionally, the reinforcement bar was covered with tape for a distance of 75 mm from both ends of the cube so that the corrosion could take place only within the 50 mm bonded length. The pull-out bond tests were conducted using an Instron Universal Testing Machine of 50KN capacity at a slow loading rate of 1 mm/min. Specimens of 150 mm x150 mm x150 mm concrete cube specimens were also prepared from the same concrete mix used for the cubes cured in water for 28 days, and accelerated with 5% NaCl solution for same 39 days and a further 21 days making a total of 60 days was consequently tested to determine bond strength.

2.4 Tensile Strength of Reinforcing Bars
To ascertain the yield and tensile strength of tension bars, bar specimens of 12 mm diameter of non-corroded, corroded and coated were tested in tension in a Universal Testing Machine and were subjected to direct tension until failure; the yield, maximum and failure loads being recorded. To ensure consistency, the remaining cut pieces from the standard length of corroded and non-corroded steel bars were subsequently used in the bond and flexural test.

3.0 Results and Discussions
Table 3.1 shows the results of pullout bond strength test of failure bond load, bond strength and maximum slip of non-corroded, corroded and mangifera indica (steel bar coated specimen) of 27 samples A – I (9 samples each for non-corroded, corroded and resins / exudates coated with varying thicknesses of 150µm,(ABC), 250µm (DEF) and 350µm (GHI) . Tables 3.2 is the derive average values of ABC to A, DEF to B and GHI to C. Percentage varying values were obtained from summarized average and used for comparison.

Figures 3.1 and 3.3 shows the results of failure bond load versus bond strength and average values of table 3.1, figures 3.2 and 3.4 shows bond strength versus maximum slip of non-corroded, corroded and coated specimens.

3.1 Non-Corroded Concrete Cube Members
Results obtained are 27.08%, 55.90% and 47.14% for failure bond load, bond strength and maximum slip.

3.2 Corroded Concrete Cube Members
Results of corroded when compared to non-corroded members, the pullout bond failure load, bond strength and maximum slip all decreased to 21.30%, 36.80%, 32.00% against 27.08%, 55.90% and 47.14% respectively.

3.2 Mangifera indica Steel Bar Coated Concrete Cube Members
In comparison to corroded concrete cube members on failure bond load, bond strength and maximum slip, coated members recorded tremendous increased by 36.49%, 66.30% and 85.50% as against 21.30%, 36.80% and 32.00% corroded respectively.

Table 3.1: Results of Pull-out Bond Strength Test (τu) (MPa)

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Corroded</th>
<th>Resin Steel bar Coated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Failure Bond Load</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bond Strength</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum Slip</strong></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
### Table 3.2: Results of Average Pull-out Bond Strength Test ($\tau_u$) (MPa)

<table>
<thead>
<tr>
<th>S/N</th>
<th>Non-corroded Control Cube</th>
<th>Corroded</th>
<th>Coated Specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Failure Bond Loads (kN)</td>
<td>Bond strength (MPa)</td>
<td>(150µm) coated (A, B, C)</td>
</tr>
<tr>
<td>Ck1-1</td>
<td>22.83</td>
<td>7.35</td>
<td>0.114</td>
</tr>
<tr>
<td>Ck1-2</td>
<td>21.97</td>
<td>7.22</td>
<td>0.099</td>
</tr>
<tr>
<td>Ck1-3</td>
<td>21.47</td>
<td>7.09</td>
<td>0.089</td>
</tr>
<tr>
<td>Ck1-4</td>
<td>23.68</td>
<td>7.75</td>
<td>0.119</td>
</tr>
<tr>
<td></td>
<td>22.18</td>
<td>7.21</td>
<td>0.102</td>
</tr>
<tr>
<td></td>
<td>23.04</td>
<td>7.96</td>
<td>0.108</td>
</tr>
<tr>
<td></td>
<td>23.18</td>
<td>7.75</td>
<td>0.094</td>
</tr>
<tr>
<td></td>
<td>21.98</td>
<td>7.81</td>
<td>0.118</td>
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<tr>
<td></td>
<td>22.84</td>
<td>7.36</td>
<td></td>
</tr>
</tbody>
</table>

|     | Bond strength (MPa) | 4.25 | 7.25 | 0.054 |
|     | 4.90 | 7.75 | 0.080 |
|     | 4.75 | 6.34 | 0.073 |
|     | 5.27 | 6.85 | 0.085 |
|     | 4.71 | 7.65 | 0.072 |
|     | 4.46 | 7.76 | 0.072 |
|     | 4.87 | 8.75 | 0.078 |
|     | 4.56 | 8.05 | 0.070 |
|     | 4.48 | 8.03 | 0.070 |

**Mangifera indica (steel bar coated specimen)**

<table>
<thead>
<tr>
<th></th>
<th>Failure load (KN)</th>
<th>Bond strength (MPa)</th>
<th>Max. slip (mm)</th>
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</thead>
<tbody>
<tr>
<td>Ck4-1</td>
<td>21.75</td>
<td>7.65</td>
<td>0.115</td>
</tr>
<tr>
<td>Ck4-2</td>
<td>22.30</td>
<td>7.85</td>
<td>0.105</td>
</tr>
<tr>
<td>Ck4-3</td>
<td>20.94</td>
<td>6.34</td>
<td>0.095</td>
</tr>
<tr>
<td>Ck4-4</td>
<td>25.53</td>
<td>6.85</td>
<td>0.112</td>
</tr>
<tr>
<td></td>
<td>24.35</td>
<td>7.65</td>
<td>0.112</td>
</tr>
<tr>
<td></td>
<td>27.05</td>
<td>7.76</td>
<td>0.105</td>
</tr>
<tr>
<td></td>
<td>25.56</td>
<td>8.75</td>
<td>0.123</td>
</tr>
<tr>
<td></td>
<td>24.43</td>
<td>8.05</td>
<td>0.171</td>
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<td>25.55</td>
<td>8.03</td>
<td>0.165</td>
</tr>
<tr>
<td></td>
<td>25.55</td>
<td>8.03</td>
<td>0.183</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Bar diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
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<td>12</td>
</tr>
<tr>
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<td>12</td>
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<td>12</td>
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<td>12</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

---

**Control, Corroded and Resin Steel bar Coated**

<table>
<thead>
<tr>
<th>S/N</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Non-corroded Control Cube</td>
</tr>
</tbody>
</table>

---

Concrete Cube
<table>
<thead>
<tr>
<th></th>
<th>CCK1-1</th>
<th>CCK1-2</th>
<th>CCK1-3</th>
<th>CCK1-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure Bond Loads (kN)</td>
<td>22.09</td>
<td>22.46</td>
<td>22.66</td>
<td></td>
</tr>
<tr>
<td>Bond strength (MPa)</td>
<td>7.22</td>
<td>7.40</td>
<td>7.64</td>
<td></td>
</tr>
<tr>
<td>Max. slip (mm)</td>
<td>0.100</td>
<td>0.104</td>
<td>0.107</td>
<td></td>
</tr>
<tr>
<td>Bar diameter (mm)</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

**Corroded**

<table>
<thead>
<tr>
<th></th>
<th>CCK 2-1</th>
<th>CCK 2-2</th>
<th>CCK 2-3</th>
<th>CCK 2-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure Bond load (KN)</td>
<td>17.76</td>
<td>17.77</td>
<td>17.74</td>
<td></td>
</tr>
<tr>
<td>Bond strength (MPa)</td>
<td>4.63</td>
<td>4.71</td>
<td>4.64</td>
<td></td>
</tr>
<tr>
<td>Max. slip (mm)</td>
<td>0.069</td>
<td>0.0.72</td>
<td>0.073</td>
<td></td>
</tr>
<tr>
<td>Bar diameter (mm)</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

**Coated Specimens**

150µm coated (A,
Mangifera indica (Steel bar Coated specimen)

<table>
<thead>
<tr>
<th></th>
<th>CCK 4-1</th>
<th>CCK 4-2</th>
<th>CCK 4-3</th>
<th>CCK 4-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure load (KN)</td>
<td>21.66</td>
<td>25.64</td>
<td>25.18</td>
<td></td>
</tr>
<tr>
<td>Bond strength (MPa)</td>
<td>7.28</td>
<td>7.42</td>
<td>8.27</td>
<td></td>
</tr>
<tr>
<td>Max. slip (mm)</td>
<td>0.105</td>
<td>0.113</td>
<td>0.174</td>
<td></td>
</tr>
<tr>
<td>Bar diameter (mm)</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
Figure 3.1: Summary Results of Pull-out Bond Strength Test ($\tau_u$) (MPa) (Failure loads versus Bond Strengths)

Figure 3.2: Summary Results of Pull-out Bond Strength Test ($\tau_u$) (MPa) (Bond Strength versus Maximum Slip)
Figure 3.3: Average Results of Pull-out Bond Strength Test ($\tau_u$) (MPa)
(Failure loads versus Bond Strengths)

Figure 3.4: Average Results of Pull-out Bond Strength Test ($\tau_u$) (MPa)
(Bond Strength versus Maximum Slip)

4.0 Conclusion

From the experimental investigations, the following conclusions were drawn:
i. Bond stresses experienced in inhibitor coated reinforcements are higher compared to the controlled specimens.

ii. Bond strength reduces linearly with increasing corrosion levels.

iii. Effect of coated thickness has much influence in the pull out as compared to the flexural characteristics, bond strength increased was noticed

REFERENCES


Cabrera, J. G. (1996). Deterioration of Concrete Due to Reinforcement Steel Corrosion, Cement and Concrete Composites, 18, 47-59


The effect of using Ordinary Cement Brands in Kenya on Corrosion Rate of Reinforced Concrete Water Conveyancing Structures

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DOI: 10.29322/IJSRP.8.4.2018.p7664
http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7664

Abstract- In the past decade Kenya has experienced an increased demand of cement for construction of infrastructure projects including the Mega standard gauge railway and the Lamu Port South Sudan-Ethiopia Transport Corridor. The cement production and consumption increased from 154,781 tonnes per year in January 2005 to 564,000 tonnes per year in January 2017 an average of 22% increment per annum. Attracted by this growth and to meet the demand, the existing manufacturers have expanded while new cement manufacturers have ventured into the Kenyan market bringing the total number of manufacturers to six. Each of the manufacturers produces his own brand of ordinary Portland cement with specific constituents but meeting the requirements of the Kenya Bureau of Standards. The constituents of the brands of cement react differently when mixed with other constituents of concrete resulting into varying hardened properties that affect corrosion. In this research three brands of ordinary Portland cement in the Kenyan market: Cem A, Cem B and Cem C were used to investigate their effect on the properties of concrete that affect the rate of corrosion.

In this research three brands of ordinary Portland cement in the Kenyan market: Cem A, Cem B and Cem C were used to investigate their effect on the properties of concrete that affect the rate of corrosion. The physical and chemical properties of the materials were investigated for compliance to applicable British and Kenyan standards. The DOE method was used to derive the mix design for a design strength of 25N/mm². Concrete materials were batched by weight and mixed by using a lab electric pan concrete mixer in batches of 0.009 m³. For each brand of cement 9 cubes of 150mm x 150mm x 150mm for compression test, 9 cylinders of 150mm x 300mm for tensile strength and 9 cylinders of 150mm x 300mm for accelerated corrosion test were cast. After 24 hours the cast specimens were demoulded and immersed in curing tanks for 28 days.

Specimens for compression and tensile test were tested at 7, 14 and 28 days while the specimens for impressed corrosion were immersed in a 3.5% industrial sodium chloride solution under a voltage and current of 6V and 2A respectively. The applied current and voltage were monitored on a biweekly basis until corrosion induced cracking appeared on the concrete surface. The impressed corrosion specimens were monitored visually using a 1000x optical magnification glass for onset of cracks and stopped when the crack width were approximately 0.1mm in width. The duration to approximated width of crack were 107 days, 115 days and 111 days for Cem A, Cem B and Cem C respectively. From the results in the research, different Kenyan cement brands of the same compressive strength have a significant effect on the rate of corrosion of reinforced concrete structures.

Index Terms- Accelerated corrosion, Cement Brand, Corrosion rate.
Introduction

The rate of infrastructure development is a key indicator of the behavior of an economy\cite{1}. For the last decade, Kenya has experienced a remarkable development of small to mega infrastructure projects attracting investors in producing construction materials including cement and steel. Cement manufacturing has attracted expansion of existing manufacturers and new ones due to existing demand in Kenya which has grown from 154,781 tons in 2005 to 564,000 in 2017 (according to Kenya bureau of statistics records) and is projected to grow steadily until 2026. Currently there are six manufacturers, each producing ordinary Portland cement with different constituent compositions under different brands to Standard Specification KS EAS 18-1\cite{2}.

The process of natural steel corrosion is very slow, requiring many years depending on environmental exposure and the properties of concrete materials to cause reasonable structural damage within the service life of the structure. Reinforced concrete has an alkaline environment that protects embedded steel from corrosion. This environment can be destroyed by carbonation or by chloride attack. It takes several years for sufficient chlorides to ingress cover concrete and destroy the passivation layer leading to corrosion of embedded steel. François & Artigüe (1998), Castel et al (2003), Vidal et al (2007) and Zhang et al (2010), who allowed their laboratory specimens to corrode naturally, had to wait for four years for steel corrosion to start and an additional two years for first cracking to occur. The rate of corrosion is thus accelerated by simulating exposure environment. The objective of this research was to investigate the effect of cement brands on the rate of corrosion.

Literature

Using a sensitivity analysis Li et al\cite{3} showed that corrosion rate is one of the most important input parameters in the corrosion-induced damage models. There is a clear relationship between corrosion rate and concrete resistivity as exhibited in Alonso et al.’s\cite{4} experimental results. From the results it was noted that accelerated corrosion tests were used without validation using natural corrosion test results. The use of small specimens (20 x 55 x 80 mm) may have a size effect on the experimental results\cite{5}. In addition to concrete resistivity, corrosion rate in concrete can be affected by other factors such as presence of cracks, concrete cover depth, among others\cite{6}.

Yalcyn and Ergun\cite{7} developed a corrosion model by studying the effect of chloride and acetate ions on the rate of corrosion and evaluated corrosion by measuring half-cell potentials (HCP) and linear polarization potential (LPR). In their model, the rate of corrosion was taken up to a period of 90 days on cylindrical specimens of 150 mm diameter x 150 mm height using Pozzolanic cement.

The rate of Corrosion in reinforced concrete structures is affected by several factors (e.g. concentration of chlorides, concrete penetrability) that vary from time to time in a water conveyance structure. This research attempts to evaluate the effect of different chemical compositions of cement (which are exhibited on cement brands) on the rate of corrosion of reinforced concrete structures.

Methodology

This study was conducted in the University of Nairobi Concrete and Materials lab where the physical properties of the materials, sample preparation and testing were done. The chemical properties of the cement brands and chloride content was done at the State Department of Infrastructure in the Ministry of Transport, Infrastructure, and Housing and Urban Development of the Government of Kenya.

3.1 CONCRETE SAMPLES

The constituent materials for preparing test samples consisted of three brands of cement A, B, C of Ordinary Portland cement (42.5N/mm²), clean river sand, and 20mm maximum size coarse aggregate and portable water.

3.1.1 Cement

Cement is the most commonly used binder material in concrete. It makes concrete impermeable by filling up the voids existing in the aggregates and provides strength to the composite mix upon setting and hardening. The cements properties tested during this research were the chemical composition. Manufacturing of Cement in Kenya is in accordance to KS EAS 18-1: 2001, an adoption of the European Norm EN 197 cement standards\cite{8}. The cements locally available are produced for specific uses\cite{9}. Three Brands of Cement
Cem A, Cem B and Cem C of type 42.5N sourced from one wholesaler from three different manufacturers were used during the research.

### 3.1.2. Other concrete materials

Table 1 shows the description and source of other constituents (materials) of concrete used in the research.

<table>
<thead>
<tr>
<th>SN</th>
<th>Description</th>
<th>Source</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fine aggregates</td>
<td>Stockpile vendor sourced from Machakos River</td>
<td>This was washed and oven dried before use</td>
</tr>
<tr>
<td>2</td>
<td>Coarse aggregates</td>
<td>Kenya builders quarry</td>
<td>5-20mm quarry graded</td>
</tr>
<tr>
<td>3</td>
<td>10mm ribbed bars</td>
<td>Local manufacturer</td>
<td>Factory cut to 400mm</td>
</tr>
<tr>
<td>4</td>
<td>Mixing water</td>
<td>Tap water in the Lab</td>
<td>Sourced from Nairobi Water and Sewerage Company</td>
</tr>
</tbody>
</table>

### 3.2. EXPERIMENTATION

#### 3.2.1. Constituent Materials Characterization

The cement and aggregates chemical elemental analysis was done in accordance to the EAS 148-2:2001 CS 91.100.10. East African Standard. The physical and mechanical properties tests on aggregates were done at the university of Nairobi Concrete laboratory.

#### 3.2.2. Concrete Mix Design

Concrete mix design is the science of correct proportioning of concrete constituent materials based on structure requirements to obtain the desired properties of concrete such as strength and practical workability \[^{10}\]. The effect of the brands of cement on the rate of corrosion was evaluated using the same concrete of design strength of 25N/mm\(^2\) designed in accordance with the DOE method.

#### 3.2.3 Test on hardened concrete

**a) Compressive strength**

The compressive strength of concrete was investigated at 7, 14 and 28 days using a digital Universal Testing Machine shown in figure 1b), with a loading capacity of 2000 KN in accordance to BS EN 12390-3:2009.

![Figure 1 Concrete Samples during Compression. a) Sample after curing, b) Digital compression testing machine, c) Concrete Sample after failure.](image)

**b) Splitting tensile test**

Split Tensile strength of concrete was tested on cylinders cast with Cem A, Cem B and Cem C. The strength of concrete was tested on cylinder at 7, 14 and 28 days curing. 7 days test was conducted to check the gain in initial strength of concrete. 28 days test gives the data of final strength of concrete at 28 days curing. Universal Compression testing machine is used for testing the Split Tensile strength test on concrete along with two wooden strips as shown if figure 2. At the time of testing the cylinder was taken out of water, dried and then tested.
3.2.4 Test on the rate of corrosion
This was done through an impressed corrosion test using the procedure below;
i) 12mm x 400mm long ribbed bars were polished with abrasive papers.
ii) 120 mm of the surface length of each bar were zinga sprayed and left to naturally dry.
iii) The mixed concrete (in two batches) was poured into cylindrical moulds (150 mm in diameter and 300 mm high) where the reinforcement was placed along its longitudinal axis.
iv) The specimens were mechanically vibrated for 60s. After 24 hours, the cylindrical concrete specimens were demoulded and cured for 28 days.
v) The test specimens were dried for 24 hours and then subjected to accelerated corrosion and stored in a tank containing 3.5 % NaCl at room temperature. The experiment was run until a crack of 0.1mm was detected.

3.2.5 Test preparation and procedure
Concrete materials were batched by weight and mixed by a lab electric pan concrete mixer in batches of 0.009 m³. Slump and compacting test were measured for all the batches as a measure of consistency and workability. For each brand of cement 9 cubes of 150mmx 150mm and 9 cylinders of 150mm x 300mm were cast. After casting;
a) The concrete specimens were kept in moulds at room temperature for 24 hours, then demoulded and kept in a curing tank for 28 days before testing.
b) The concrete cubes and cylinders were tested for compression and tensile strength at 7, 14 and 28 days.

4 RESULTS AND DISCUSSION.

4.1 Results
i) Chemical Properties of Cements in Kenya
Three types of cements were investigated during the research and Tables 2 gives the chemical properties of the different brands Cem A, Cem B and Cem C of the grade 42.5N Cement.

<table>
<thead>
<tr>
<th>SN</th>
<th>Test</th>
<th>Result</th>
<th>Cem A</th>
<th>Cem B</th>
<th>Cem C</th>
<th>KS EAS 18-1: 2001 Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CaO%</td>
<td></td>
<td>59.86</td>
<td>59.11</td>
<td>58.82</td>
<td>Sum ≥ 50</td>
</tr>
<tr>
<td>2</td>
<td>SiO₂%</td>
<td></td>
<td>16.56</td>
<td>21.56</td>
<td>19.47</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SO₃%</td>
<td></td>
<td>2.02</td>
<td>2.78</td>
<td>2.03</td>
<td>≤ 3.5</td>
</tr>
<tr>
<td>4</td>
<td>MgO%</td>
<td></td>
<td>1.76</td>
<td>1.04</td>
<td>0.57</td>
<td>≤ 5</td>
</tr>
<tr>
<td>5</td>
<td>K₂O%</td>
<td></td>
<td>0.027</td>
<td>0.051</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Fe₂O₃%</td>
<td></td>
<td>2.32</td>
<td>3.48</td>
<td>1.44</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Al₂O₃</td>
<td></td>
<td>7.61</td>
<td>8.09</td>
<td>6.85</td>
<td>3-8</td>
</tr>
<tr>
<td>8</td>
<td>Na₂O₂%</td>
<td></td>
<td>0.054</td>
<td>0.018</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>LOI%</td>
<td></td>
<td>0.11</td>
<td>0.10</td>
<td>4.75</td>
<td>≤ 5</td>
</tr>
<tr>
<td>10</td>
<td>CI%</td>
<td></td>
<td>0.012</td>
<td>0.016</td>
<td>0.014</td>
<td>≤ 0.1</td>
</tr>
<tr>
<td>11</td>
<td>IR%</td>
<td></td>
<td>2.20</td>
<td>0.55</td>
<td>1.96</td>
<td>≤ 5</td>
</tr>
</tbody>
</table>
ii) Properties of aggregates
Various tests were carried out on the aggregates to determine their suitability for the research and the results are shown in table 3 and graphs 1 and 2. Water soluble chlorides ions percent were found to be zero in fine aggregates, 0.002 % in coarse aggregates all less than 0.03% acceptable in compliance with BS EN 12620:2002.

Table 3: Physical properties of aggregates used in the study

<table>
<thead>
<tr>
<th>SN</th>
<th>Property</th>
<th>Test Method</th>
<th>Result</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Loss Angeles Abrasion value</td>
<td>BS/EN 1097-2</td>
<td>20%</td>
<td>30%</td>
</tr>
<tr>
<td>2.</td>
<td>Flakiness index</td>
<td>BS/EN 933-3</td>
<td>35%</td>
<td>&lt;35%</td>
</tr>
<tr>
<td>3.</td>
<td>Aggregate Crushing Value</td>
<td>BS EN 1097-2</td>
<td>18%</td>
<td>&lt;45%</td>
</tr>
<tr>
<td>4.</td>
<td>Aggregate Impact Value</td>
<td>BS EN 1097-2</td>
<td>8%</td>
<td>&lt;45%</td>
</tr>
<tr>
<td>5.</td>
<td>Bulk specific gravity</td>
<td>ASTM C128</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Water absorption capacity</td>
<td>ASTM C127</td>
<td>1.20%</td>
<td></td>
</tr>
</tbody>
</table>

Graph 1: Gradation of Coarse aggregates

Graph 2: Gradation of fine aggregates

iii) Results of compression test

Graph 3: Compressive strength of concrete vs testing age

iv) Splitting tensile test result
Tables 4-6 shows the result of the splitting tensile test while Tables 7 and 8 shows a comparison of the result of this research with existing research.

Table 4: Result of tensile strength ($f_t$) of concrete samples from three cement brands

<table>
<thead>
<tr>
<th>SN</th>
<th>Cement Brand</th>
<th>Strength in N/mm$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7 days</td>
</tr>
<tr>
<td>1.</td>
<td>Cem A</td>
<td>2.59</td>
</tr>
<tr>
<td>2.</td>
<td>Cem B</td>
<td>2.07</td>
</tr>
<tr>
<td>3.</td>
<td>Cem C</td>
<td>1.77</td>
</tr>
</tbody>
</table>
Table 5. Result of relationship of compressive strength ($f_{ck}$) and tensile strength ($f_t$) of concrete samples from three cement brands

<table>
<thead>
<tr>
<th>SN</th>
<th>Cement Brand</th>
<th>Strength in N/mm$^2$</th>
<th>Rate of Corrosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cem A</td>
<td>$f_{ck}$ 25.81</td>
<td>$f_t$ 3.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 days</td>
<td>14 days</td>
</tr>
<tr>
<td>2.</td>
<td>Cem B</td>
<td>$f_{ck}$ 36.379</td>
<td>$f_t$ 2.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 days</td>
<td>14 days</td>
</tr>
<tr>
<td>3.</td>
<td>Cem C</td>
<td>$f_{ck}$ 34.81</td>
<td>$f_t$ 2.48</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 days</td>
<td>14 days</td>
</tr>
</tbody>
</table>

Table 6. Predicted splitting tensile strength of concrete from different models.

<table>
<thead>
<tr>
<th>Cement Brand</th>
<th>Compressive strength (N/mm$^2$) at 28 days</th>
<th>Split tensile strength in N/mm$^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$f_t1 = 0.249f_{ck}^{0.722}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ACI Committee 318(2014)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$f_t2 = 0.56f_{ck}^{0.5}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$f_t3 = 0.387f_{ck}^{0.63}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CEB-FIB(1991)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$f_t4 = 0.3f_{ck}^{0.66}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gardner (1990)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$f_t5 = 0.33f_{ck}^{0.667}$</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SN</th>
<th>Cement Brand</th>
<th>Rate of Corrosion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$f_{ck}$</td>
</tr>
<tr>
<td>1.</td>
<td>Cem A</td>
<td>25.81</td>
</tr>
<tr>
<td>2.</td>
<td>Cem B</td>
<td>36.379</td>
</tr>
<tr>
<td>3.</td>
<td>Cem C</td>
<td>34.81</td>
</tr>
</tbody>
</table>

Table 7. Checking variance and normality assumptions on the sample datasets.

<table>
<thead>
<tr>
<th>SN</th>
<th>Sample</th>
<th>Variance</th>
<th>Test P-value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Experiment</td>
<td>0.047</td>
<td>0.03</td>
<td>Observations in Sample have normal distribution</td>
</tr>
<tr>
<td>2.</td>
<td>$f_{t1}$</td>
<td>0.021</td>
<td>0.01</td>
<td>Observations in Sample have normal distribution</td>
</tr>
<tr>
<td>3.</td>
<td>$f_{t2}$</td>
<td>0.005</td>
<td>0.32</td>
<td>Observations in Sample have normal distribution</td>
</tr>
<tr>
<td>4.</td>
<td>$f_{t3}$</td>
<td>0.011</td>
<td>0.04</td>
<td>Observations in Sample have normal distribution</td>
</tr>
<tr>
<td>5.</td>
<td>$f_{t4}$</td>
<td>0.010</td>
<td>0.41</td>
<td>Observations in Sample have normal distribution</td>
</tr>
<tr>
<td>6.</td>
<td>$f_{t5}$</td>
<td>0.008</td>
<td>0.07</td>
<td>Observations in Sample have normal distribution</td>
</tr>
</tbody>
</table>

Table 8. Welch’s 2-sample t-test.

<table>
<thead>
<tr>
<th>SN</th>
<th>Data</th>
<th>t-statistics</th>
<th>P-Value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Experiment and $f_{t1}$</td>
<td>0.40</td>
<td>0.06</td>
<td>On average samples are not significantly different</td>
</tr>
<tr>
<td>2.</td>
<td>Experiment and $f_{t2}$</td>
<td>0.05</td>
<td>0.47</td>
<td>On average samples are not significantly different</td>
</tr>
<tr>
<td>3.</td>
<td>Experiment and $f_{t3}$</td>
<td>0.29</td>
<td>0.07</td>
<td>On average samples are not significantly different</td>
</tr>
<tr>
<td>4.</td>
<td>Experiment and $f_{t4}$</td>
<td>0.01</td>
<td>0.50</td>
<td>On average samples are not significantly different</td>
</tr>
<tr>
<td>5.</td>
<td>Experiment and $f_{t5}$</td>
<td>0.18</td>
<td>0.11</td>
<td>On average samples are not significantly different</td>
</tr>
</tbody>
</table>

v) Rate of corrosion
Table 9 shows the properties of the rebar used in the research and the rate of corrosion.

Table 9. Physical property of the reinforcement in impressed corrosion Test

<table>
<thead>
<tr>
<th>SN</th>
<th>Cem</th>
<th>Diameter</th>
<th>Area</th>
<th>Length</th>
<th>Initial</th>
<th>Average</th>
<th>Mass Weight</th>
<th>Duration</th>
<th>Rate of</th>
</tr>
</thead>
</table>
### Type (mm) mm² mm Mass Kg after corrosion Kg Loss Kg in Hours Corrosion mm/yr

1. Cem A 12 113.143 400 0.371 0.265 0.106 109 x 24 0.38
2. Cem B 12 113.143 400 0.371 0.299 0.072 115 x 24 0.27
3. Cem C 12 113.143 400 0.371 0.256 0.115 106 x 24 0.43

Corrosion Rate in mm/yr = $87.6 \times \left(\frac{w}{D \times A \times T}\right)$

Where $W$ is the weight loss in milligram,

$D$ is the density of the material used, g/cc,

$A$ is the area of the specimen (cm²), and

$T$ is the duration of the test period in hours.

### 4.2 Discussion of results

#### 4.2.1 Properties of aggregates and water

The fine aggregates were free of silt, clay and any other deleterious material and had a maximum aggregate size of 5 mm. This was achieved using a British standards sieve with 5 mm maximum aperture. Both the fine and coarse aggregates were suitable for concrete production. The water used for the work was potable water from Nairobi water and sewerage Company and suitable for concrete production.

#### 4.2.2 Chemical Composition of Cement Samples

The different brands however had varying properties which can be attributed to their manufacturing processes. The difference in chemical composition of the various brands and types of cements are reflected in the difference in their mechanical properties and in the qualities of concrete produced by the different types of cements and thus it directly affects the compressive strength of concrete.

- **Effect of sum of lime (CaO) and silicon dioxide (SiO₂)**

  From table 2 there is a notable variation in the amounts of CaO, SiO₂ and Insoluble Residue. Cem A has the highest amount of CaO (59.86%), Cem B has the highest SiO₂ (21.56%) and Cem A has the highest Insoluble residue (2.20%). Table 3 shows the chemical composition of the different cement samples used in this research. All the cement samples substantially complied with British Standards requirements for ordinary Portland cement.

  The sum of lime (CaO) and silicon dioxide (SiO₂) obtained in the chemical analysis of ordinary Portland cement should not be less than 50% [11]. All cement samples used for this work satisfied this requirement. Cement sample B has a CaO + SiO₂ value of 80.67 % and produced the highest compressive strength of 44.89 as shown in table 5 This is consistent with the known fact that both CaO and SiO₂ give strength to concrete though SiO₂ has to be limited relative to CaO in order not to negatively affect setting time.

- **Effect of CaO/SiO₂**

  The ratio of lime (CaO) to silicon dioxide (SiO₂) contents in ordinary Portland cement should be greater than 2. The restriction on the ratio of lime to silicon dioxide [11] is to ensure that the quantity of silicon dioxide is considerably lower than that of lime so that the setting of concrete is not inhibited. All the cement samples investigated satisfied this requirement. The lime-silicon dioxide ratio for cement samples A, B, and C were 3.61, 2.71 and 3.0 respectively. The results also indicated that the higher the ration of (CaO/SiO₂) of a cement sample the higher the compressive strength of concrete which can be produced from it and the lower the rate of corrosion.

- **Effect of MgO**

  The quantity of magnesium oxide (MgO) in ordinary Portland cement should not exceed 5% [2]. All the cement samples satisfied this requirement with 1.76%, 1.04% and 0.57% for cement samples A, B, and C respectively. Magnesium oxide contributes to colour of cement and hardness of the resulting concrete. Cement sample A with the highest MgO content of 1.76 % was expected to produce concrete with the highest compressive strength since MgO contributes to hardness of concrete and lowest rate of corrosion. If the quantity of MgO is in excess of 5 percent, cracks will appear in concrete and which may affect the rate of corrosion by generating spots for penetration of chloride ions in concrete.

- **Effect of SO₃**

  The quantity of sulphur trioxide (SO₃) content in ordinary Portland cement should be less than 3.5 %. All the samples satisfied this requirement.

- **Effect of Chloride Content**

  The chloride content in ordinary Portland cement should be less than 0.4%. All the cement samples in this work satisfied this requirement.

- **Effect of Al₂O₃**

  Aluminium oxide (Al₂O₃) aids the quick setting of cement paste. Cement sample B contained the highest quantity of 8.09 % of Al₂O₃ resulting in the fastest initial set of the cement paste.
Effect of Fe$_2$O$_3$
Iron oxide (Fe$_2$O$_3$) contributes to cement colour and helps in the fusion of the different ingredients. The Fe$_2$O$_3$ contents for the different cement samples are 2.32, 3.48 and 1.4493 for cement samples A, B, and C respectively as shown in Table 5.

Effect of Residues
British standards consider Na$_2$O, K$_2$O, TiO$_2$ and P$_2$O$_5$ in ordinary Portland cement as residues and limit the sum of all of them to 5%. All the cement samples investigated satisfied this requirement with cement samples A, B and C having total residue contents of 0.55, 2.2 and 1.96% respectively. If in excess of 5% efflorescence and unsightly cracking will occur.

CONCLUSION
The following conclusions have been reached from the outcome of this work:

i) The rate of corrosion is affected by the compressive strength of concrete which depends on the chemical properties of cement exhibited in the brand of cement with properties of the other concrete matrix material remaining the same. From the results of this research the different cement brands however had varying chemical properties. The brand with the highest lime (CaO), silicon dioxide (SiO$_2$) and Magnesium oxide content in cement had the highest compressive strength of concrete and the lowest rate of corrosion.

ii) Electrochemistry is a feasible method to evaluate the rate of corrosion of a steel bar embedded in concrete under accelerated corrosion.

iii) Based on the results of statistical analysis, predicted values of splitting tensile strength were not significantly different from the experimental values for the sample of cast for experiments for all the models.

References

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Satellites: The differential equations of motion of the system

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Abstract- This paper deals with the analyses of the effect of earth's oblateness and magnetic force on the motion of a system of two particles. The relative motion of the particles, for case of circular motion of the center of mass of the system; The satellites may oscillate about some equilibrium position of the system in elliptical orbit. In three dimensional spaces, the particle is bound to attain the sphere. At a certain moment and after that the motion will take place with tight string and the particle will start moving on the surface of the sphere.

Index Terms- Motion, sphere, circular orbit, Equilibrium, tight string

\[(i) \phi = 0 \quad ; \quad \psi = \sin^{-1} \left( \frac{A}{3 - 5A_0} \right)\]
\[(ii) \phi = 0 \quad ; \quad \psi = 0\]

Mathematical Approach

Suppose the center of mass of the system moves in a circular orbit so that \( e = 0 ; \rho = 1; \rho' = 0 \)

The equation of the system becomes

\[
\begin{align*}
    x'' - 2y' - 3x &= \lambda x^x - 4A_0^x - A \cos \gamma \\
    y'' + 2x' &= \lambda y^y + A_0^y \\
    z'' + z &= \lambda z^z + A_0^z - \frac{A}{\mu E} (3\rho^3 - \mu_E) \sin (\nu + \omega) \sin \theta
\end{align*}
\]

We have

\[
A = \frac{m_1}{m_1 + m_2} \left( \frac{Q_1}{m_1} - \frac{Q_2}{m_2} \right) \frac{\mu E}{\sqrt{\mu \rho}}
\]

\[
\lambda \alpha = \frac{\rho^3 \rho'^4}{\mu} \left( \frac{m_1 + m_2}{m_1 \cdot m_2} \right) \lambda
\]

\[
A_0 = \frac{-3k_2}{\rho^2}
\]

The condition of the constraint is

\[
x^2 + y^2 + z^2 \leq 1
\]
There are three cases arise
(i) Loose string
(ii) Tight string
(iii) Alternately loose and tight string

Now for (i)
\[ x^2 + y^2 + z^2 \leq 1 \quad \text{and} \quad \lambda_\alpha = 0 \]
\[ \therefore m_2 \text{moves inside the sphere} \quad x^2 + y^2 + z^2 \leq 1 - - - - - (3) \]

The equation (i) becomes
\[ \begin{cases} x'' - 2y' - 3x = -4A_0 - Acos i \\ y'' + 2x' = A_0^\gamma \\ z'' + z = A_0^z - \frac{A}{\mu_E} (3\rho^3 - \mu_E) \sin(v + w) sini \end{cases} - - - - - (4) \]

The first two equations be reduced as
\[ \begin{cases} x'' - 2y' - (3 - 4A_0)x = -Acos i \\ y'' + 2x' = A_0^\gamma \end{cases} - - - - - (5) \]

The homogeneous equation
\[ z'' + z(1 - A_0) = 0 \]
\[ z'' + z(1 - A_0) = 0 \]
\[ z' = -((1 - A_0)z \text{ in simple H. motion with period} \quad \frac{2\pi}{\sqrt{(1 - A_0)}} \]
\[ \therefore z = c \cos \sqrt{(1 - A_0)} \cdot v + D \cdot \sin \sqrt{(1 - A_0)} \cdot v \]

We take trivial soln
\[ \begin{cases} x = Me^{mv} + \frac{Acos i}{(3 - 4A_0)} \\ y = Ne^{mv} \end{cases} - - - - - - - - (6) \]
\[ \begin{cases} x' = M \cdot me^{mv}; y' = N \cdot me^{mv} \\ x'' = M \cdot m^2 e^{mv}; y'' = N \cdot m^2 e^{mv} \\ x''' = M \cdot m^3 e^{mv}; y''' = N \cdot m^3 e^{mv} \end{cases} - - - - - - - - - - (7) \]

From (4); we replace the values (7)
\[ Mm^3 - 2Nm^2 (3 - 4A_0)Mm = 0 \]
\[ Nm^2 + 2Mm - A_0 \cdot N = 0 \]
i.e. \( M(m^2 + 4A_0 - 3) + (-2m)N = 0 \)
and \( M(2m) + (m^2 - A_0)N = 0 \)

Condition for solvability
\[
\begin{vmatrix}
    m^2 + 4A_0 - 3 & -2m \\
    2m & m^2 - A_0
\end{vmatrix} = 0
\]

\[m^4 + m^2(3A_0 + 1) + (3 - 4A_0)A_0 = 0\]

\[(m^2)^2 + m^2(3A_0 + 1) + (3 - 4A_0)A_0 = 0\]

\[m^2 = \frac{-(1 + 3A_0) \pm \sqrt{(25A_0^2 - 6A_0 + 1)}}{2}\]

Taking positive sign
\[m^2 = \frac{1}{2} \left[ (1 + 3A_0) + \sqrt{(25A_0^2 - 6A_0 + 1)} \right]\]

\[m_1, m_2 = \pm \frac{i}{\sqrt{2}} \sqrt{(1 + 3A_0) + \sqrt{(25A_0^2 - 6A_0 + 1)}}\]

Taking Negative sign
\[m^2 = \frac{1}{2} \left[ \sqrt{(25A_0^2 - 6A_0 + 1)} - (1 + 3A_0) \right]\]

\[m_3, m_4 = \pm \frac{1}{\sqrt{2}} \sqrt{(25A_0^2 - 6A_0 + 1) - (1 + 3A_0)}\]

The general solution
\[x = Mm_1e^{m_1v} + Mm_2e^{m_2v} + Nm_3e^{m_3v} + Nm_4e^{m_4v}\]

Now
\[N(-2m) + (m^2 - 4A_0 - 3)M = 0\]

\[\frac{M}{2m} = \frac{N}{m^2 - 4A_0 - 3}\]

If it possible
\[m = m_1\]
\[M = Mm_1\]
By observing the general solution of them we say that appearing term $e^{m_3v}$ in $x$ and $y$, $m_3$ are real and positive. It then in definite increase of time $V$, the expression for $x$ and $y$ will increase indefinitely. We say that $m_2$ is bound to touch the circle $x^2 + y^2 = 1$

But in three dimensional spaces ($\mathbb{R}^3$) the particle $m_2$ bound to attain the sphere $x^2 + y^2 + z^2 = 1$

II. CONCLUSION

A certain moment the motion will take place with tight string and the particle will start moving on the surface of the sphere.

REFERENCES


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Work life conflict and its impact on Turnover intention of Employees: The Mediation Role of Job satisfaction

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Abstract- Apparel industry has been the Sri Lanka’s largest gross export earner and it is considered as one of the biggest industries in Sri Lanka. However, employees are facing many issues in balancing of their work life and family life in the apparel industry. Employees are assets to the organization and the organization always tries to avoid losing the key performers. Therefore, apparel companies are providing attractive benefits to the. Yet, employee turnover has become a critical problem for this industry. Thus, this study empirically evaluated the relationship between work life conflict and turnover intention and the mediation role of job satisfaction. Convenience sampling method was employed to select 100 operational level employees from 10 apparel companies in Katunayaka Export Processing Zone and data were gathered by using self-administered questionnaires. Besides, study found the strong positive relationship between work life conflict and turnover intention and it is partially mediated by the job satisfaction. Moreover, the study revealed that turnover intention is varied with gender differences in apparel industry and females have high level of turnover intention than male workers.

Index Terms- Work Life Conflict, Job Satisfaction, Turnover Intention

I. INTRODUCTION

Employees are assets to the organization and the company always tries to avoid losing the key performers. Therefore, apparel companies are providing attractive benefits to the employees like attractive salary, transportation facilities, medicine etc. However, employee turnover is a critical problem to maintain the competitive advantages of the industry (Liyanage et al., 2014). Therefore, turnover is a serious threat to the productivity of the organization.

The fast moving world and the ever changing atmosphere in private sector organizations demand a low turnover rate for successful operations at low cost. Managing multiple roles across the different domains increases interpersonal conflicts and intrapersonal conflicts of employees, which further can result in Work Life Conflict (WLC) (Rathi & Barath, 2013). Researchers found that WLC creates a path to labor turnover and it has positive relationship with Turnover Intention (TI) (Fernando, 2015). However, Pradana & Salehudin (2013), have found that WLC does not influence on TI. Hence, there are contradictory arguments.

Sri Lankan garments are facing the problems in developing and maintaining the required manpower (Dheerasinghe, 2009). According to the researchers apparel industry has struggled with difficult situations for continue the success. The industry faces issues such as employee TI and cost of production. According to the data of BOI- Katunayake, total employment of the Export Processing Zone (EPZ) was reduced to the 37,474 from the 42,329 during March 2012 to March 2016. There are 4,855 employees left the EPZ in last five years. Operational level employees were highly left from the EPZ than the managerial level workers. Thus, the main purpose of this study is to understand the mediation role of Job Satisfaction (JS) between the WLC and TI in apparel industry. Following are the key objectives of this study.

- To identify the relationship between WLC and JS in apparel industry.
- To identify the relationship between JS and TI in apparel industry.
- To identify the relationship between WLC and TI in apparel industry.
- To identify the mediate role of JS between WLC and TI in apparel industry.
- To identify the variation of TI in terms of gender differences in apparel industry.

1.1 Work life conflict (WLC)

WLC occurs when the collective demands of individuals’ two roles are incompatible. Therefore, participation in one role is made more difficult by participation in the other role. Greenhaus & Beutell (1985) suggest that conflict occurs when either time devoted to the requirements of one role, or strain from participating in a role, or specific behaviors required by a role, make difficult to fulfil the requirements of another. There are multiple forms of WLC that originate from different sources. Kotze & Villers (2003), defined that most significant WLC arises from complex workplace issues, including managing change, supervisory and technical competences, leadership, roles and accountabilities etc.

Studies in the area of WLC has mainly concentrated on the conflict between people’s work and other life roles. The WLC arising when work roles interfere with family roles and family related roles interfere with work related roles. The concept “work life balance” had different meanings for different individuals. It is generally accepted that there is a clear link between WLC and work life balance. As attaining work life balance is dependent on managing or reducing the conflict between various roles (Kotze & Villers, 2003).

1.2 Job satisfaction (JS)

Job satisfaction was explained as a function of job features, other people and personal dispositions. Under social exchange relationships, employees are more likely to remain with an organization if they feel that their supervisors value their contributions and well-being, communicate well with them, and treat them with respect and recognition. Further, organizational culture also influences on the JS of the employee (Medina, 2012). The concept of JS has been developed in many ways by many different researchers with their new findings. JS can be seen within the broader context of the range of issues. It can be impact on individual's quality of working life. To be a successful organization, it must continuously ensure the satisfaction of employees.

JS is closely related to the performance and quality of work performed by an employee. The competitors can imitate other assets like technology, processes and methods, while the HR are unique to the organization. Organizations are investing a lot on HR in terms of recruiting, training, developing, maintaining and retaining them in the organization. Spector (1997), has defined the nine factors for measure the JS. The nine facets are Pay, Promotion, Supervision, Fringe Benefits, performance based rewards, Operating Procedures, Coworkers, Nature of Work, and Communication. These factors figure into an individual’s job satisfaction in this study.

1.3 Turnover intention (TI)

Today’s business organizations are faced major problem that their vital employees are leaving from the organization. Employee turnover has always been a matter of concern for organizations. It is serious issues especially in the field of HRM. A large degree of employee turnover may be harmful to both the organization as well as the employee’s career (Saeed et al, 2014). The number of employees’ positive intention to leave is create problems form of weakening internal HR strength (Ghayyur & Jamal, 2012).

TI has been incorporated into most employee turnover models in the published literature (Medina, 2012).TI is an intention that employee has, to leave the organization. In other words, intention to leave a job is an immediate precursor to actually leaving. Therefore, retain of employee is an important part of building sustainable competitive edge for any business (Pradana & Salehudin, 2013).

Mobley, Homer & Hollingsworth (1978), have defined three dimensions for measuring TI. According to researchers TI is an attitudinal (thinking of quitting), decisional (intention to leave), and behavioral (searching for a new job) process. It is very important to minimize the TI of the skilled employees for longer time period. According to the past researchers, employees’ TI arises due to role conflict between dual careers. Therefore, the employees’ retention strategy through balance work and life approach is important for the organization (Ghayyur & Jamal, 2012).

1.4 Link between Work Life Conflict, Job Satisfaction and Turnover Intention

WLC & JS may have detrimental consequences for employees through the high demands and expectations from both work and the family domains. Because of high work demands, workers spend more time on the job and get very little time for their family (Rathi & Barath, 2013). According to the key findings of (Akram & Hassaan, 2013; Fernando, 2015; Rathi & Barath, 2013) WLC has a negative relationship with JS. Moreover, WLC were created less performances and it created job dissatisfaction. Further, FIWC is weakly negatively related to JS (Akram & Hassaan, 2013). Therefore, this study has formulated the hypothesis in following way.

Hypothesis 1: There is a negative relationship between work family conflict and job satisfaction.

Hence, JS is work related research topic in the field of organizational behavior. According to Spector (1997), there is an association between JS and TI of employees. When the employees are not satisfied with their jobs and organizations do have not trust in their employees, the employee’s TI will be greater. Researchers identified JS as the best indicator of employ intention to perform. Saeed et al, (2014) indicates that there is a negative and significant relationship between JS and TI of employees in various industries and employees who have higher JS were less likely to leave the companies. It was also agreed with the findings of studies done by Choo et al, 2013 and Ozba & Cicek, 2014. Mобильy et al (1978), explained that JS leads to the individual thinking of quitting, which in turn may lead to intention to search for alternatives and ultimately to an intention to quit. According to Liyanage & Galhena (2011), employees leave their jobs when their needs are not being satisfied by present job and an alternative job becomes available. Based on above arguments, this study has developed following hypothesis.

Hypothesis 2: There is a negative relationship between Job Satisfaction and Turnover Intention.

Further, WLC causes to the TI which ultimately has negative effect on organization performance (Alsam et al., 2013). Researchers have found that, WLC has a positive effect on TI (Ozba & Cicek, 2014; Ghayyur & Jamal, 2012). Further, Haar & Roche (2012), explained that WIF and FIW as predictors of TI. However, some researchers found that, WLC does not influence on TI significantly (Pradana & Salehudin, 2013). Contradictory arguments are visible in the current literature. Mihelic (2014), found that employees with younger children are less likely to think about leaving the organization. Studies have identified that, WLC for married respondents with higher impact on TI. Based on above contradictory findings, following hypothesis was formulated.

Hypothesis 3: There is a negative relationship between work family conflict and turnover intention.

Finally, this study also believe that the job satisfaction can mediate the relationship between WLC and TI since job satisfaction was identified as a pleasurable or positive emotional state resulting from the appraisal of one’s job (Locke, 1976). Previous researches have already identified WLC as an antecedent of job satisfaction (Akram & Hassaan, 2013; Fernando, 2015; Rathi & Barath, 2013) meanwhile TI as a consequence of Job satisfaction (Liyanage & Galhena, 2011; Spector, 1997). But, the interrelationship between WLC and TI through JS was not found and this study has formulated a
hypothesis as follow with the aim of addressing above knowledge gap.

**Hypothesis 4:** Job satisfaction mediates the relationship between work life conflict and turnover intention.

### 1.5 Variation of WLC, JS and TI in terms of Gender Differences.

Social judgment for men usually comes from work role and social judgment for women usually comes from family role. Women do substantially more housework than men, and this is especially true for married men and women. (Xu, 2009). However, today trend of dual earner families is increasing rapidly than before. Therefore, married women also entering into the corporate world. If women involve much in work, it will differ from social expectations which will lead to WLC in a high degree (Xu, 2009).

King, (2005) explained that, there is no differences between men and women in WLC. Both men and women are equally benefited by the family supportive culture of any organization and did not differ significantly on the social support they received from their workplace (Baral & Bhargava, 2011).

Some researchers were suggested that the women experience higher levels of WLC than men (Greenhaus and Beutell, 1985 ; Dheerasinghe, 2009; Saeed et al, 2014). There are contradictory arguments. Moreover, Saeed et al (2014), found that TI of females varies from TI of males. Therefore, this study was based on the gender differences to find variation of WLC based TI with gender differences.

### 1.6 Conceptual framework

![Conceptual framework](image.png)

**Figure 1: Conceptual framework**

### II. METHODS

The study investigated the mediating effects of JS on the relationship between WLC and TI. The target population is defined as the entire group a researcher is interested in. There are 13 EPZs administrates under the BOI. Among them Katunayake EPZ contributes to highest employment opportunities. Therefore, all the operational level employees in apparel companies of Katunayake EPZ were considered as the population. 100 operational level employees (58 females and 42 males) were selected according to the stratified sampling technique from the 10 apparel companies. A survey method was adopted for collecting data from operational level employees and self-administered questionnaire was utilized as the data collection tool.

### 2.1 Measures and Materials

**Work Life Conflict:** WLC was measured through a scale consisting eight items under the two dimensions namely work interference with family conflict (WIFC)and family interference with work conflict (FIWC) developed by Gutek, Searle, and Klepa (1991). Four items targeted WIFC. Four items measured FIWC. Response options were based on a 5-point Likert scale that ranged from strongly disagrees to strongly agree. The reliability (Cronbach alpha) of the work-family conflict scale in this study was 0.87.

**Job Satisfaction:** The Job Satisfaction Survey developed by Spector (1997) was used to measure the variable job satisfaction using nine dimensions and this questionnaire is widely used in many researches and well established among the other job satisfaction scales. The Cronbach alpha value for the job satisfaction was obtained as 0.88. Data were collected using five point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).

**Turnover Intention:** Turnover Intention was measured with the three-item measure used by Pfeffer (2007). Participants responded to items such as “I am thinking about leaving this organization” using a 5- point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The reliability (Cronbach alpha) of the work-family conflict scale in this study was 0.78.

Hence, descriptive analysis was used to analyze the level of WLC, TI and JS. Correlation and regression analysis were utilized to analyze the relationship of the variables. Further, to analyze the mediation role of JS, Baron and Kenny mediation and Sobel test were adopted. Finally, ANOVA was used to identify the variation of TI in terms gender differences.

### 2.2 Profile of the sample

The sample was comprised with, 42% of male employees and 58% of female employees. Majority of them were fallen between the age of 21-40 which is about 50% of the total sample. Further, the sample shown that the majority of the participants were sewing machine operators (34%). The results constitute that 36% employees are married while only 64% are single. Hence, 68% of the employees’ partners (spouse) were not engaged in paid employment and only 32% of them were having paid employment. Besides, most of the employees have no children (57%).

### III. RESULTS

#### 3.1 Descriptive Analysis

The mean value of WLC was 3.1513 (2.5 <x < 3.5 which implies that employees moderately agreed with the existing level of WLC and it has dispersed by 0.4940 of standard deviation from its mean. The mode of 3.38 represented that the most of the operational level employees had agreed with the existing level of WLC. Coefficient of variation denoted that the employees moderately agreed with the existing level of WLC and did not differ significantly on the social support they received from their workplace (Baral & Bhargava, 2011).

The mean value of Turnover Intention was measured with the three-item measure used by Pfeffer (2007). Participants responded to items such as “I am thinking about leaving this organization” using a 5- point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The reliability (Cronbach alpha) of the work-family conflict scale in this study was 0.78.

Hence, descriptive analysis was used to analyze the level of WLC, TI and JS. Correlation and regression analysis were utilized to analyze the relationship of the variables. Further, to analyze the mediation role of JS, Baron and Kenny mediation and Sobel test were adopted. Finally, ANOVA was used to identify the variation of TI in terms gender differences.
Mean value of JS is 3.1233. Mean value was between the range of 2.5 < 3.1233 < 3.5, it discovered that employees moderately agreed for existing level of pay, promotion, supervision, fringe benefits, performance based rewards, operating procedures, coworkers, nature of work, and organizational communication. It has dispersed by 0.3849 of standard deviation from its mean. The mode of 2.89 represented that the most of the operational level employees had moderately agreed with the existing situation of JS. Coefficient of variation denoted that the dispersion of data points in a data series around the mean which was 12.32% represented operational level employees had same attitude towards their JS.

Hence, the mean value of employee TI was 2.9633. It implies that employees moderately agreed with the aforementioned process of TI. The mode of 3.17 represented that the most of the operational level employees moderately agreed with the existing situation of TI and its dimensions. When consider the standard deviation, higher value represents that response for TI was not widely dispersed from its mean value. The standard deviation and coefficient of variance is 0.5619 and 18.96% respectively. Highest coefficient variation represents that there is a similar level of perception towards the TI.

### 3.2 Correlation Analysis

Table 1: Summary of correlation analysis (with Hypothesis)

<table>
<thead>
<tr>
<th></th>
<th>P Value</th>
<th>Alternative Hypothesis</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>WLC and JS</td>
<td>0.000</td>
<td>Rejected H1 accepted</td>
<td>0.05</td>
</tr>
<tr>
<td>JS and TI</td>
<td>0.000</td>
<td>Rejected H2 accepted</td>
<td>0.05</td>
</tr>
<tr>
<td>WLC and TI</td>
<td>0.000</td>
<td>Rejected H3 accepted</td>
<td>0.05</td>
</tr>
</tbody>
</table>

The Table 1 shows the summary of correlation analysis. Accordingly, correlation between WLC and JS was -0.762 which implied that there is a strong negative relationship between WLC and JS. The relationship is significant since the p-value is 0.000. Therefore, the null hypothesis was rejected (H0) and accepted the alternative hypothesis (H1) which says that there is a negative relationship between WLC and JS.

Hence, the job satisfaction is inversely related to turnover intention. Correlation coefficient between JS and TI was -0.771. It suggested that there is a strong negative relationship between JS and TI among operational level employees in apparel sector. Moreover, the p-value was 0.000 which indicates that the relationship between JS and TI was significant. Therefore, researcher rejected the null hypothesis (H0) and accepted alternative hypothesis (H1) which is there is a negative relationship between JS and TI.

This study also tested the impact of WLC on TI. The findings & the data empirically proved the facts detailed in the literature review. Due to high work demands, employees spend more time on the job and get very little time for their family. It has impact on the employee turnover intention. Accordingly, the Pearson’s correlation between WLC and TI was 0.786 which implied that there is a strong positive relationship. Furthermore, p-value of 0.000 emphasizes that the relationship is significant between WLC and TI. Therefore, the null hypothesis (H0) was rejected and accepted the alternative hypothesis (H1) which is there is a positive relationship between WLC and TI.

### 3.3 Regression and Mediation Analysis

This study also aimed at identifying the mediating role of JS between the relationship of WLC and TI. To achieve this objective, study was utilized Baron and Kenny mediation analysis. Following figures shows the paths which explain the relationship among independent, dependent and mediating variables.

According to the Figure 2, paths a, b and c are called direct effects. The mediation effect, in which WLC leads to TI through JS, is (path c’) called the indirect effect. The purpose of the path c, a, b is to establish that zero order relationships among the existing variables. According to the analyzed data following relationships are significant, therefore researcher was concluded that mediation is possible.

Hence, study compared the results of following Table 2, simple regression weight on WLC when prediction of TI (Path-a) and Multiple regression weighted on WLC and JS both are together to prediction of TI (Path- b) to identify the mediation effect of JS between WLC and TI. In this study H4 addressed the role of JS as a mediator in the relationship between WLC and TI. Path C indicates that the total effect of WLC on TI (B = 0.894, p=0.000) decreases when the mediator JS is included in the model (B= 0.537, p=0.000). The direct effect of WLC on TI decreases but it was significant.

Table 2: Summary of regression analysis

<table>
<thead>
<tr>
<th>Path</th>
<th>Unstandardized Beta</th>
<th>Std. Error</th>
<th>Standardized Beta</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.894</td>
<td>0.071</td>
<td>0.786</td>
<td>0.000</td>
</tr>
<tr>
<td>A</td>
<td>-0.593</td>
<td>0.051</td>
<td>-0.762</td>
<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td>-1.126</td>
<td>0.094</td>
<td>-0.771</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Moreover, the strength of $c'$ has reduced drastically (unstandardized beta value difference between $c$ and $c'$ is 0.357). Therefore, JS is a partial mediator of the relationship between WLC and TI. Moreover, the indirect effect of WLC on TI.

The Sobel test was used to calculate the mediate effect of JS between WLC and TI in apparel industry. Following table presents the overall summary of the path and b. From that Table 3, researcher is calculated the Sobel test results by using Microsoft Excel and online Sobel calculator (http://quantpsy.org/sobel/sobel.htm).

**Table 3: Summary of path a and b**

<table>
<thead>
<tr>
<th>Path</th>
<th>Unstandardized Beta</th>
<th>Std. Error</th>
<th>Standardized Beta</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.051</td>
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<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td>-1.126</td>
<td>0.094</td>
<td>-0.771</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Figure 3: Results of the Sobel analysis

$$Z = \frac{ab}{\sqrt{(b^2SE_a^2) + (a^2SE_b^2)}}$$

- $a = \text{Unstandardized Beta of path a}$
- $s_a = \text{Standard error of path a}$
- $b = \text{Unstandardized Beta of path b}$
- $s_b = \text{Standard error of path b}$

According to the results of Figure 3, statistic for the Sobel test is 8.34, with an associated p-value of 0.000. The fact that the observed p-value falls below the established alpha level of 0.05 indicates that the association between the WLC and the TI has reduced significantly by the inclusion of the JS in the model. This attests that due to mediation 39.94% of controllability is demonstrated by JS, when mediating between WLC and TI. Therefore, alternative hypothesis which is JS mediates the mediating role of JS between WLC, and TI in apparel industry. Therefore, JS is a significantly mediate role of JS between WLC, and TI in apparel industry.

### 3.4 ANOVA test of TI in terms of gender variation

One-way ANOVA test was used to identify the difference of the TI in terms of gender variation. According to the results, a significant difference can be identified between two groups when considering the mean values and standard deviation. Females are having 3.129 of mean value and 0.453 of standard deviation. Further, male have 2.731 of mean and 0.619 of standard deviation. Therefore, females have high level of TI than the males.

### IV. DISCUSSION

This study examined the relationship between WLC and JS and found a negative relationship. As mentioned in the literature review, the effect of WLC on JS is still arguable. Researchers argued that there is no relationship between WLC and JS and others argued that there is negative relationship. The findings of the research are consistent with results of previous research undertaken in other occupations. According to Akram & Hassaan (2013), individuals feel more dissatisfied when their work hinder with their family life. Further, Ozbag & Cicek (2014) suggested that managers should pay more attention to the employees who are working in the context of working at night, on weekends, and during public holidays to minimize WLC of the employees.

Moreover, study revealed that there is a significant strong negative association between JS and TI. The findings of this study are consistent with results of (Ozba & Cicek, 2014) that, higher level of job satisfaction is associated with lower levels of TI maybe because satisfied employees are more likely to be more effective in handling WFC. Further, there is a significant strong positive association between WLC and about 61.8 % of the variation in employees’ TI can be attributed to difference in employees’ levels of WLC.

The findings of study also agreed with the findings of Fernando (2015) saying that, WLC adversely affected to workers’ performance and dissatisfaction of workers in this industry and it creates absenteeism and labor turnover within the industry. WLC have created path to low performance of workers and TI in this industry. Rathi & Barath (2013) explains that, good working and living conditions of police personnel make it interesting and informative to understand their work and family life, and how and to what extent their life is influenced by the support from co-workers. Alsam (2013) explains that those managers who face work life conflict confronted with TI very soon, so organization consider such polices that help to control turnover rate. It proved that there is a strong positive relationship between WLC and TI in apparel industry.

In this study $H_4$ addressed the role of JS as a mediator in the relationship between WLC and TI. According to the results Sobel test value is 8.34, with an associated p-value of 0.0000. If the Z value falls outside that range, the pattern exhibited is probably too unusual to be just another version of random chance and the p-value will be small to reflect this ($p < 0.05$). Therefore, it is possible to reject the ($H_0$) and accept the ($H_4$) there is a mediate role of JS between WLC, and TI in apparel industry. There are 39.94% of controllability is demonstrated by JS, when mediating between WLC and TI. Therefore, JS is a significantly mediate the relationship between WLC and TI in apparel industry.

According to Greenhaus & Beutell (1985), time devoted to the requirements of one role makes it difficult to fulfill requirements of another. Majority of women are still primarily...
responsible for the home and children’s activities than the males and difficult to balance the demands arising from family and work roles. This was cause to the higher value of TI of women. Prior researchers were also suggested that the women experience higher levels of WLC than men. The findings of this study are consistent with results of previous research undertaken in other occupations (Umer & Rehman, 2013). It is obvious that women have to take care of her children, husband and other dependents. Also she has to take care of all household affairs like cooking, cleaning etc. By being more educated and competent than in earlier times and sometime even to act as a helping hand to her husband financially she is doing job also. All these responsibilities create work life imbalances and WLC of women which leads to TI among female workers compare to male workers.

V. CONCLUSION AND SUGGESTION

According to the concluded results, this study has identified key implications to minimize the employee TI of operational employees in apparel sector. Moreover, these recommendations can be used to minimize the employee’s WLC and enhance their JS. Accordingly following are the few implications and recommendations.

Firstly, Managers should be sensitive to WLC of employees and reduce their work load. Managers have to identify the employees work related issues and have to provide best solution to them. Since employees are like to work with the friendly staff members and management. As an example, an employee who is having infant child dislike to work at the night shifts. In this situation managers have to provide acceptable and friendly solution to her.

Secondly, it is better to improve the employees’ benefits based on their service period and experiences. Apparel sector provides attractive benefits for their employees based on their performances. However, apparel employees have to work hard with their targets. It is enhancing the employees’ WLC and TI. Therefore, researcher suggested to introduce service period based benefit system to motivate and retain employees in the organization.

Thirdly, it is ideal to establish welfare unions to provide special benefits to the employees. Sometimes, apparel can be a strategic business unit of a large scale company. In this situation, the company can provide special offers to their employees through other business units. For the purpose of developing relations among all the employees, company can establish the welfare unions. Through the unions organization can improve the employee’s team work, enhance the employer employee relationship and finally the JS of the employee is enhanced. Through the welfare union of the organization can be organized get together parities, trips, New Year festival etc.

Fourthly, it is necessary to clearly explain the task, duties and responsibilities of the employees. Organizations can clearly explain the task, duties and responsibilities of employee in their recruitment notice. It is useful to recruit the most suitable person to the organization and make employees- job fit. Therefore, it reduces the ambiguity and the turnover rate of the employees. Because, the employee can understand his responsibilities and duties that he should perform in the organization and it minimizes the employee’s TI.

Fifthly, organizations can arrange the special events to spouses and family members of the employee. It helps to get to know each other and identify the working environment. Through this events organization can draw the picture regarding work life of employee in spouse’s mind. Further, company can interpret the importance of employees’ job to the employee’s family.

Next, it is advised to introduce better leave scheme. The main reason behind this suggestion is most of the employees who are working in apparel sector live far away from their home town and residing boarding places surrounded to the work place. Therefore, this study suggested providing either paid or unpaid leave for employees and it will help to minimize the WLC and TI of employees.

Finally, organization can facilitate employees through mentoring and counseling services. Experiences in work can impact on employees TI in many ways namely harassment of senior person, family related issue, personal issue etc. In this situation company can provide the mentoring and counseling service for employees those who are affected by above issues and seeking help. It is minimizing the employees WLC and finally it will reduce the rate of labor turnover.

5.1 Limitations of the research

The study covered limited geographical area and questionnaires were given to 100 operational level employees from 10 apparel organizations. It would have been more useful if all the apparel firms were covered in the EPZ. However, time period of the research and budget constrains have caused to this limitation. There are some difficulties of getting information from the respondent. Respondents are reluctant to provide answers. Further, this study has been conducted as cross sectional study.

5.2 Directions for future research

This study was focused on the operational level employees in apparel industry. The study also can focus on other level of employees. In addition, study can be conducted as a comparative study based on other control variables namely age, marital status and tenant in organization etc. to get the more effective result. Further, this research model can be adapted to the other industries in the economy. Moreover, study recommends considering other factors like training, motivation as mediator to determine the mediation effect between WLC and TI.

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https://quantpsy.org/sobel/sobel


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THE ROLE OF NGO’s ON FOOD SECURITY.

(THE CASE OF URBAN DIRE DAWA ADMINISTRATION COMPASSION INTERNATIONAL DONATED CHILD DEVELOPMENT PROJECT)

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Abstract: The overall purpose of this study was to examine the role of NGO’s in alleviating food insecurity in Urban Dire Dawa Compassion International Donate Child Development Project. The research incorporated both primary and secondary data. The primary data were collected from beneficiaries through self administered questionnaire where as secondary data were reviewed mainly from published journal articles and books. Descriptive research design and quantitative research method were utilized to identify the role of NGO’s in alleviating food insecurity in Urban Dire Dawa Compassion International Donate Child Development Project. The collected data were processed and analyzed through descriptive analysis, and to see the relationship between variables correlation analysis methods were employed. To process the collected data analysis SPSS version 20 was used. This study found that the beneficiaries general life was changed after the beneficiaries are joined the project.

Keywords: Food in/security, Urban Dire Dawa Administration Compassion International Donated Child Development Project.

Introduction

Food insecurity occurs when people do not have enough food to satisfy hunger, have an insufficient and limited diet, are anxious about having enough food or need to resort to make shift coping strategies such as begging, scavenging, or relying on emergency assistance programmes (Cook and Frank, 2008).

The new global and African food security agenda is overwhelmingly productionist and rural in its orientation, and is based on the premise that food insecurity is primarily a rural problem requiring a massive increase in smallholder production. This agenda is proceeding despite overwhelming evidence of rapid urbanization and the growing likelihood of an urban future for the majority of Africans. Urban food insecurity can therefore no longer be ignored. Achieving urban food security is the emerging development challenge for the 21st century and that the complexities of urban food systems urgently need to be addressed by researchers, policy makers, and international donors and multilateral agencies. (Jonathan S Crush & G Bruce Frayne, 2011)

Ethiopia, a country that has a lengthy history of challenges linked to rural food security, is currently facing relatively new challenges related to urban food insecurity (Tesfay Birhane, 2014).

The food security challenges facing the urban poor, and the factors that affect urban food systems, can no longer be wished away or marginalized. Urban food insecurity is not reducible to the ‘grow more’ solutions currently on offer in the world of international development. There needs to be greater recognition by international organisations, regional bodies and national and sub national governments that urban food security is a critical issue requiring urgent attention. The food security strategies of the urban poor, and how these are thwarted or enabled, are critical to the future stability of African cities and the residents’ quality of life (Jonathan S Crush & G Bruce Frayne, 2011)

International child sponsorship is one of the leading forms of direct aid from households in wealthy countries to needy children in developing countries, where we estimate that 9.14 million children are currently supported through formal international sponsorship organizations. The world’s third largest child sponsorship program is Compassion International, a large, faith-based,
nonprofit organization whose stated goal is to “release children from spiritual, economic, social, and physical poverty.” The benefits sponsored children receive vary somewhat by country, and even within countries, and Compassion’s approach has evolved over time (Bruce W, et al., 2013).

Different authors in the area of food in different period and in different countries did research but there is limited research on role of NGOs in our country especially in urban areas and the problem also still exists. In addition to what had been done in other countries and in our country the study need to assess the role of Urban Dire Dawa Compassion International Donated Child Development Project on food security. Accordingly, the researchers were addressing the following basic research questions.

Research questions
Under this study the following basic research questions was raised and properly addressed.

✓ To what extent Urban Dire Dawa Compassion International Donated Child Development Project intervene to alleviate food insecurity?
✓ To what extent the pro poor section of the society life was changed due to the intervention of Urban Dire Dawa Compassion International Donated Child Development?

Specific Objectives
✓ To see the extent of Urban Dire Dawa Compassion International Donated Child Development Project intervention to alleviate food insecurity.
✓ To examine the extent of the pro poor section of the society life changed due to the intervention of Urban Dire Dawa Compassion International Donated Child Development Project.

RELATED LITRETURE REVIEW

Definition food security/insecurity

Poverty and food insecurity are the most crucial and persistent problems facing humanity. As the scale of human activities expands, the capacity of eco-systems to regenerate the natural resource base becomes an increasing constraint to growth and development (Abebaw Shimelis and Ayalneh Bogale, 2007). Regardless of the many efforts made, deepening food crises in several developing countries specially those in sub-Saharan Africa is still the concern of many researchers, planners, donors and international development agencies, who have given high priority to the study of food systems and the problem of food security (Gezahneg K, 1995). Even though the availability of resources and the efforts made by governments in most of these countries, food insecurity and declining food production per capita remained among the most crucial issues (Bogale and Shimelis, 2009).

Food insecurity incorporates low food intake, variable access to food, and vulnerability livelihood strategy that generates adequate food in good times but is not resilient against shocks. These outcomes correspond broadly to chronic, cyclical and transitory food insecurity, and all are endemic in Ethiopia (Stephen Devereux and IDS Sussex, 2000).

Nowadays, food security/insecurity has gained great attention by policy makers, researchers, governmental and non-governmental organizations and development workers. In line with this, ensuring food security remains a key issue for the government of Ethiopia. In order to combat threats of famine and pervasive poverty by ensuring food security for its population, the government strategy has rested on increasing the availability of food grains through significant investments in agricultural technologies (high yielding varieties of seeds and fertilizer), services (extension, credit, input delivery), and rural infrastructure (roads, markets). However, the impacts of these policies have been shadowed as there are still millions of people who experience extreme hunger in the country. According to the report of food and agricultural organizations of united nation, 41 % of the Ethiopian population lives below the poverty line and more than 31 million people are undernourished (Bogale and Shimelis, 2009; FAO, 2010).

Empirical evidence

In the late 1990s, the International Food Policy Research Institute (IFPRI) found high levels of urban food insecurity in developing countries around the globe (Ruel et al., 1999). The IFPRI examined data from household surveys in 10 African countries and found that ‘contrary to expectations, the percentage of the population found to be energy deficient is higher in urban areas in six of the ten countries studied. In all countries except Kenya and Uganda, at least 40% of the urban population is energy deficient; with percentages reaching 90% in urban Ethiopia and 76% and 72% in urban Malawi and Zambia, respectively’. Additionally, Birara Endalew (2015) said that Ethiopia has experienced long periods of food insecurity. Among Sub-Saharan countries, Ethiopia is the worst of all regions in prevalence of undernourishment and food insecurity. Nearly 33 million people are suffering from chronic undernourishment and food insecurity. This indicates that Ethiopia has one of the highest levels of food insecurity in the world, in which more than 35% of its total population is chronically undernourished. Ethiopia is characterized by extreme poverty, high population growth rate, severe environmental degradation and recurrent drought. Ethiopia is currently facing challenging problems to achieve food security.

If improved food security is to be achieved in poor, food insecure countries of Africa, Asia, Latin America and the Caribbean, close donor and government coordination and collaboration is essential (Barry M. Riley, 2000). According to UNICEF (2009) the food security and vulnerability study for urban Ethiopia has largely been necessitated by the new increased food insecurity stemming largely from the global economic food price, which has been translated to the country partly through high inflation rates.

The role of donors/NGOs in alleviating food insecurity

International child sponsorship is one of the leading forms of direct aid from households in wealthy countries to needy children in developing countries, where we estimate that 9.14 million children are currently supported through formal international sponsorship

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www.ijsrp.org
organizations. International child sponsorship programs arose due to their usefulness as a marketing tool for mobilizing resources in rich countries to reduce poverty in poor countries. As the marketers of these programs have recognized for decades, contact with an individual child creates a commitment device to help donors contribute a fraction of their monthly income to alleviating child poverty in developing countries via a relationship with a particular child living in poverty. The world’s third largest child sponsorship program is Compassion International, a large, faith-based, nonprofit organization whose stated goal is to “release children from spiritual, economic, social, and physical poverty.” Compassion staffs its projects locally, and foreign employees are rare. The projects rely on volunteers from local churches and other organizations to carry out its programming. The benefits sponsored children receive vary somewhat by country, and even within countries, and Compassion’s approach has evolved over time (Bruce W, et al., 2013).

According to data received from Urban Dire Dawa Compassion International Donated Child Development Project from the year 2005-untill now, there are eight Child Development project which consists around 250 beneficiaries in each project. For the sake of this study the researchers take three Child Development project as a target population.

**Material and method**

**Research Design**

Mixed research methodology was applied because the researchers used both qualitative and quantitative research method for collecting and analyzing the data. To assess food insecurity and identify the roles played by the Urban Dire Dawa Compassion International Donated Child Development Project in alleviating food insecurity of pro poor section of the society. To describe the beneficiaries’ life change after they joined the project, descriptive type of study were employed.

**Target population**

Urban Dire Dawa Administration Compassion International Donated Child Development Project beneficiaries were the target population.

**Sample size**

The sample size was taken from the total population of 750 beneficiaries, which are 260. If the population size is known, the Yamane formula for determining the sample size is given by:

\[ n = \frac{N}{1 + Ne^2} \]

Where, \( n \) = corrected sample size, \( N \) = population size, and \( e \) = Margin of error (MoE), \( e = 0.05 \) based on the research condition. The sample size would be:

\[ n = \frac{750}{1 + 750(0.05^2)} = 285.71 \sim 260 \]

**Sampling technique**

Since the researchers have got only one NGO involving on food security of urban Dire Dawa Administration the researchers take as it is. Accordingly, the management body of Urban Dire Dawa Compassion International Donated Child Development Project and direct/indirect beneficiaries’ were our potential source of primary data. To select sample from three Urban Dire Dawa Administration Compassion International Donated Child Development Projects simple random sampling were used.

**Source of data and method of data collection**

Both primary and secondary data were used. Formal questionnaires were prepared and administered to collect primary data, key informants were interviewed to supplement and verify the information collected through formal questionnaires.

**Method of data analysis**

The data was analyzed both qualitatively and quantitatively. Qualitative method of analysis is used to analyze data obtained from the interviewee of Urban Dire Dawa Compassion International Donated Child Development Project staff. Descriptive statistics was used to analyze the data obtained by questionnaire from the beneficiary.

**Result and discussion**

The data analysis of this research was both descriptive and qualitative. The descriptive statistics includes frequency, percentage. Primary data was collected through self administered close-ended questionnaires that were prepared by referring different literature in the study area and distributed to beneficiaries of Urban Dire Dawa Compassion International Donated Child Development Project to meet the objectives of the study. The researchers designed 12 questionnaires based on the previous livelihood life change after beneficiaries joined the project. The samples were 260 respondents and 249 of the questions were return back and the analyses were done on those response.

<table>
<thead>
<tr>
<th>Item</th>
<th>Alternatives</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-15</td>
<td>77</td>
<td>30.9</td>
<td></td>
</tr>
<tr>
<td>16-19</td>
<td>153</td>
<td>61.4</td>
<td></td>
</tr>
<tr>
<td>20-22</td>
<td>19</td>
<td>7.6</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>249</td>
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<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>126</td>
<td>50.6</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>123</td>
<td>49.4</td>
<td></td>
</tr>
</tbody>
</table>

**Table 1: socio demographic back ground of the respondents**
As it is indicated on table 1, the majority of the respondents 153 (61.4%) are between the ages of 16-19, on average 92.3% of the respondents age fall between 12-19. Most of the respondent were joined the project when it was start function in 2005 GC hence they are using the service for the past 9 and above years. Regarding the sex distribution of the respondents it is proportionally divided between male and female. Half of the children joined the project are most vulnerable section of the society (female). Majority of the families of the respondents 134 (53.8%) have between 3-4 family members and the rest 115 (46.1%) are between 5-9 family size. Size of the family has direct impact on level of food security therefore, this project contribute a lot to reduce food insecurity in urban Dire Dawa Administration. The educational status of the respondents fall between 5-8 grade are 101 (40.6%) and 96 (38.6%) of the respondent are preparatory and college student. Education is very important for alleviating food insecurity since the children in the project have promising future to be able to work and benefit themselves and their family. Most of the house hold included in our study have one child (86.7%) joined the project and few of the respondent have two and three family member in the project 34 (13.2%).

As it is depicted on above table 106 (42.6%) did not worry about their food consumption. 57(22.9%) of the respondent sometimes worry about their food consumption while the rest 86(34.5%) of the respondent were always worry about their food consumption. Around 105(42.2%) of the respondents did not worry about food where as 56(22.5%) worry sometimes about food, and the rest 88 (35.5%) were always worry for their food intake. Regarding the balanced diet 64(25.7%) ate the balanced food and 61(24.5%) sometime gain balance diet whereas 124(49.8%) always did not get balanced diet. Respondents were asked about number

<table>
<thead>
<tr>
<th>Item</th>
<th>Alternatives</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you worry about food consumption before you join the project</td>
<td>No worry</td>
<td>106</td>
<td>42.6</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>57</td>
<td>22.9</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>86</td>
<td>34.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>How many times you worry about food consumption before you join the project</td>
<td>No worry</td>
<td>105</td>
<td>42.2</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>56</td>
<td>22.5</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>88</td>
<td>35.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>For how many times you eat balanced meal before you join the project</td>
<td>No worry</td>
<td>64</td>
<td>25.7</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>61</td>
<td>24.5</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>124</td>
<td>49.8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>For how many times you lack food in your home before you join the project</td>
<td>No worry</td>
<td>73</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>101</td>
<td>40.6</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>75</td>
<td>30.1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>For how many times you lack food in your home because of lack of money before you join the project?</td>
<td>No worry</td>
<td>73</td>
<td>29.3</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>78</td>
<td>31.3</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>98</td>
<td>39.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>For how many times did you eat per day before you join the project</td>
<td>One time a day</td>
<td>53</td>
<td>21.3</td>
</tr>
<tr>
<td></td>
<td>Two times a day</td>
<td>114</td>
<td>45.8</td>
</tr>
<tr>
<td></td>
<td>Three times a day</td>
<td>82</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
</tbody>
</table>
of times they lack food and replied as 73(29.3%) of them did not lack food, 101(40.6%) sometimes lack foods the rest 75(30.1%) always lack food to eat in their home. About 73(29.3%) of the respondents be able to fulfill their food consumption, 78(31.3%) of the respondent sometimes lack food because of unavailability of money additionally, 98(39.4%) always lack food because of lack of money. About 53(21.3%) of the respondents were able to ate food once a day, 114 (45.8%) of them ate twice a day whereas only 82(32.9%) of the respondent were able to eat three times a day.

<table>
<thead>
<tr>
<th>Item</th>
<th>Alternatives</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you worry about food consumption after you join the project</td>
<td>No worry</td>
<td>180</td>
<td>72.3</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>53</td>
<td>21.3</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>16</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>How many times you worry about food consumption after you join the project</td>
<td>No worry</td>
<td>175</td>
<td>70.3</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>60</td>
<td>24.1</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>14</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>For how many times you eat balanced meal after you join the project</td>
<td>No worry</td>
<td>121</td>
<td>48.6</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>58</td>
<td>23.3</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>70</td>
<td>28.1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>For how many times you lack food in your home after you join the project</td>
<td>No worry</td>
<td>196</td>
<td>78.7</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>46</td>
<td>18.5</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>7</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>For how many times you lack food in your home because of lack of money after you join the project?</td>
<td>No worry</td>
<td>150</td>
<td>60.2</td>
</tr>
<tr>
<td></td>
<td>Sometimes</td>
<td>48</td>
<td>19.3</td>
</tr>
<tr>
<td></td>
<td>Always</td>
<td>51</td>
<td>20.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
<tr>
<td>For how many times did you eat per day after you joined the project</td>
<td>One time a day</td>
<td>6</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>Two times a day</td>
<td>18</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td>Three times a day</td>
<td>225</td>
<td>90.4</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>249</td>
<td>100</td>
</tr>
</tbody>
</table>

As it is depicted on above table 180 (72.3%) did not worry about their food consumption. 53(21.3%) of the respondent sometimes worry about their food consumption while the rest 16(6.4%) of the respondent were always worry about their food consumption. Around 175(70.3%) of the respondents did not worry about food where as 60(24.1%) worry sometimes about food, the rest 14(5.6%) were always worry for their food intake. Regarding the balanced diet 121(48.6%) ate the balanced food and 58(23.3%) sometime gain balance diet whereas 70(28.1%) always did not get balanced diet. Most of the time the beneficiaries’ gained balanced meal after they joined the project. Respondents were asked about number of times they lack food and replied as 196(78.7%) of them did not lack food, 46(18.5%) sometimes lack foods the rest 7(2.8%) always lack food to eat in their home. As it is compared from the previous food status now there is very much change takes place in beneficiaries’ life in relation to food consumption. About 150(60.2%) of the respondent be able to fulfill their food consumption, 48(19.3%) of the respondent sometimes lack food because of unavailability of money additionally, 51(20.5%) lack food. Even if the beneficiaries have good change in their life they are not free totally from food related problem. About 6(2.4%) of the respondents were able to ate food once a day, 18 (7.2%) of them ate twice a day whereas 225(90.4%) of the respondent were able to eat three times a day. In general there Urban Dire Dawa Compassion International Donated Child Development Project played a great role in maintaining food security for those pro poor sections of the society.

INTERVIEW RESULT
The social worker and the activity facilitator of Compassion International Donated child development project were asked about the different service provided to the beneficiaries. The researchers presented the response by categorizing into four services.

Health screening
Heath service is provided to the beneficiaries through annual checkup for all the beneficiaries. Every six month checkup for beneficiaries below 12 year from 2005-2016, Stating 2017 all beneficiaries are examined by doctor once a year, medical service are given as the beneficiary face any kind of health problem. Sanitary materials provided to the female beneficiaries. For Direct beneficiaries who are living with HIV 700 birr worth food commodities plus 75 worth detergent material is provided every month,
Indirect beneficiary who are living with HIV 75 worth detergent material also provided every month, Indirect beneficiary who are bed rear are entitled for 500 birr worth food commodity every month. Highly vulnerable children (HVC) are provided 350 birr worth food commodity, and TB patient beneficiaries are given 500 worth food commodities until they are cared per month. As per the interview with officials health education is provided by dividing the beneficiaries in to different age group by the nurse of the project and other health related training are given by inviting health professionals.

2. Social component of Urban Dire Dawa compassion international Donated Child Development Project

As the interview on Social worker of the project Campaign is prepared for Beneficiaries above 14 years for five consecutive days in one place by making group of four once a year. Under those days the following major activities were carried out. Different training and social activities are given such as experience sharing by practicing, life skill training, ethical service, recreational service. At the evening of last day there are canfire ceremonies. It will end by giving certificate of participation. Additionally, there is sporting activities on every Sunday. There is sport training of male beneficiaries. They are trained under club by having a professional and paid coach; the members of the club have food service after training. Visiting the home of beneficiaries and discussion takes place with their family about their children education, behaviour and other issues.

There is Gift presentation program to the beneficiary as the sponsor send. With consultation of the beneficiary the gift is given in kind. Creating conducive relationship with the sponsor, like writing letter, sending photo graph, Consultation are given to beneficiaries as required. Full cloths to beneficiaries twice a year are provided. All the beneficiaries obtain 3-4 peace of soap, 14-20 kg teff is provided and one cosmetics oil per 3-4 months.

According to the response of the interviewee the social service of the project is extended up to the provision of legal service if there is any court case of the beneficiary there will be lawyer who represents those beneficiaries.

3. Cognitive service of Urban Dire Dawa compassion international Donated Child Development Project

The beneficiaries are entitled for full materials of education, uniform, tutor class from KG-12 grade. The library is built up with sufficient required books to increase the student performance. In addition to this counseling service is provided for them to control the performance of the beneficiaries in education and beneficiaries prepare their plan for future in all the component of the project and evaluate it every quarterly by cross checking the plan to the actual performance and taking the necessary measures if any deviation are found. There are monthly meeting with the beneficiaries’ family.

4. Ethics service of Urban Dire Dawa compassion international Donated Child Development Project

As the interviewee responded ethical education is provided for beneficiary every Saturday for those who are above age 10 and every Sunday for those beneficiaries below 10 years old.

Major finding, Conclusion and recommendation

Major Finding

The number of respondent who are always worrying about their food consumption before joining the project was reduced from 34.5% to 6.4% after joining the project, the number of times the respondent always worrying about their food consumption was reduced from 35.5% to 5.6%, the respondent who did not get balanced meal were reduced from 49.8% to 28.1%, those who lacks any food at their home was reduced from 30.1% to 2.8%, those who had not any food because of lack of money were reduced from 39.4% to 20.5%, the number of meal per day that the respondent was taken increased from 32.9% to 90.4%. In general, the majority of the beneficiaries are able to eat three times per day after joining the project.

Conclusion

Urban Dire Dawa compassion international Donated Child Development Project is being contributing a lot for the reduction of food insecurity by providing different services to the pro poor section of the society. As the data showed the beneficiaries’ life was changed greatly after the project provide them the necessary food support.

Policy Implication and Recommendation

✓ Urban Dire Dawa compassion international Donated Child Development Project have to work to improve the pro poor section of a society through creating sustainable income generating activities by providing training on entrepreneurship, business plan development, etc, in order to make the beneficiary self sustained in food and finance.

✓ Since food insecurity is widely spread problem in Ethiopia, government has to design policy framework which attract food NGO’s to address the problem from grass root level through;

  ➢ Consideration of the existence of urban pro poor section of the society and identifying those pro poor.
  ➢ Supporting those interested international and local food NGO’s in urban areas through provision of different facilities such as land, office, soft infrastructure, etc...

✓ It is better for the government to effectively work in collaboration with indigenous and international food NGO’s and the government has to take initiative to coordinate food NGO’s effort who are working on urban areas of Ethiopia in order to jointly work towards alleviating food problems.

References


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The Effectiveness of Reward System In Pusrawi International College of Medical Sciences (PICOMS) Malaysia

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* Pusrawi International College of Medical Sciences

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Abstract- PICOMS has been implementing some intrinsic and extrinsic reward systems. This paper focuses on investigating the effectiveness of this reward system. A questionnaire survey has been carried out within the institution among 180 employees and students. Further, this paper will evaluate the worthiness of implementing such reward system, and also suggesting possible improvements to further enhance the effectiveness of its reward system.

Index Terms- Reward management system, PICOMS, Reward system effectiveness on educational institution, Reward recruitment, Motivation, Performance.

I. INTRODUCTION

For many years, PICOMS has been adopting a reward system to reward its staffs and employees whenever they are able to recruit and get in students into the institution. This comes in the form of monetary compensation after the students have officially joined the institution and named the staff or employee as his or her referral. Additionally, PICOMS has also been holding a number of lucky draw sessions during its monthly assembly sessions, as another mean to attract and encourage its students to join its assembly. During those assemblies, the top 3 employees with the highest recruitments will be announced and recognised.

The purpose of this paper is therefore to gather and analyse feedback from PICOMS' students and staffs to understand the effectiveness of its current reward systems, whether such systems are meeting the objectives that they are supposed to fulfill to make it worthwhile to continue implementing such systems.

II. RESEARCH ELABORATIONS

There are essentially two types of reward systems, which are the intrinsic rewards where non-monetary means were involved after accomplishing something and this is where the incumbents are rewarded through the increasing feel of self-accomplishment and self-esteem (Honig-Haftel & Martin, 1993). The management of PICOMS do believe in intrinsic rewards by announcing the top 3 employees who managed to recruit the most students for a specific month during its monthly assemblies. Through this, PICOMS are providing recognitions to its employees to form a sense of self-accomplishment and to encourage the other employees to do better too. Additionally, the management is implementing extrinsic reward systems too where monetary incentives (Honig-Haftel & Martin, 1993) are given for successful student recruitments. Through both intrinsic and extrinsic reward systems, the management aims at placing PICOMS as a high performing organisation, as supported by Armstrong, Brown and Reilly (2009).

There have been numerous studies that connect reward with performance. Most of the studies, such as the ones done by Hansen (1997) and Stajkovic & Luthans (2001) showed that whenever reward systems are in place, performance tends to increase. Brown and Reilly (2009) have supported this statement by providing real life examples of famous organisations such as Standard Chartered Bank, Tesco, as well as McDonalds which managed to prove this theory to be right. Kituyi, Musau and Thinguri (2014) have decided to zoom into the effectiveness of reward systems in the area of educational institution and have concluded on positive effects too.

The management of PICOMS therefore believes in the principle that individuals will perform better when they are properly rewarded, both intrinsically and extrinsically. By putting a "carrot on a stick" as a type of performance-driven reward (Brown & Reilly, 2009), the management aims at encouraging its staffs to bring in more students as it believes such a method will yield better results as compared to other advertising efforts. This is because when a student gets recruited in by an employee, the student will be able to understand more on the benefits and reasons to join PICOMS compared to other educational institutions, since the employee will convince the student with facts and figures. Unlike other methods of advertising such as social media, television and radio; potential students may not be able to understand PICOMS as much as being convinced through word of mouth.

Therefore, the management of PICOMS strongly believes in the effectiveness and efficiency of its current reward systems.

The effectiveness of reward systems can be measured through a number of measures. Brown & Reilly (2009) have suggested measures such as the satisfaction of employees and customers, the turnover rates of employees, customer satisfaction, the profitability of organisations, the rate of vacancies available as well as the period taken for those vacancies to be filled. This study therefore focused on some of
the measures mentioned to gauge the effectiveness of its reward systems.

III. METHODOLOGY

The researcher has applied the quantitative methodology where questionnaires were designed and distributed to staffs and students of PICOMS. The questionnaire is appended as Appendix 1. The respondents shall choose one selection for each effectiveness criteria in the form of Likert Scale, ranging from strongly agreeing, merely agreeing, being neutral, merely disagreeing and strongly disagreeing.

The forms were physically handed out to the respondents and then collected back to be keyed into Microsoft Excel. A total of 200 respondents were randomly selected to fill up the forms. Out of that number, a total of 180 respondents have responded, therefore giving a response rate of 90%. These responses will be processed and analysed using Microsoft Excel.

IV. RESULTS AND DISCUSSIONS

The chart of the results is depicted in Appendix 2. Appendix 3 shows the results in number of respondents. Appendix 4 shows the results as percentages. The results and discussions below will mainly be based on the results as percentages.

Around 83% of the respondents strongly perceived that the current reward systems implemented in PICOMS are actually effective and meeting its objectives. This stands as a majority win compared to only a mere 12% of respondents being merely agreeing, followed by a dropping 3% being neutral, 2% disagreeing and 1% strongly disagreeing. This shows that the initiatives that the management of PICOMS has been implementing in its rewards management system is working, and being effective in doing what they are supposed to do.

Seventy three percent of the respondents believed that the number of students within PICOMS is increasing every semester. This is also a majority win against 18% others being merely agreeing, 5% neutral, 3% disagreeing and 1% strongly disagreeing. The respondents have managed to see the results from the reward management strategies that the management is implementing, and therefore opined that such systems are indeed effective.

When it comes to the recruited students are more effective and efficient, also a majority 84% strongly agreed to this statement, as compared to 10% being merely agreeing, 3% neutral and another 3% being disagreeing to this statement. The respondents have seen this initiative being able to produce quality students, and that the recruited students do not join the institution just for the purpose of joining. They are not the kind of "rubbish" students, and in fact are serious about excelling in their courses and getting top notch results. This will therefore improve the overall results of the institution, along with increasing the students' employability after they have graduated.

Eighty three percent of the respondents opined this initiative as being effective at improving the relationships between the staffs and the students. This is followed by a series of dropping percentages in those respondents being agreeing at 12%, neutral at 3%, disagreeing at 2% and strongly disagreeing at 1%. The respondents have seen improvements in the ties between the staffs of PICOMS with the students after the reward systems were implemented years ago. They therefore believe that in the absence of these systems, these relationships may not be as close as compared to present conditions. In this sense, the reward systems are effective in forming close rapport among everyone within the institution.

Also, a majority of 88% perceived that the motivation among the staffs were in fact increased from the implementation of these reward systems. This is followed by 7% being merely agreeing, 3% neutral, and 2% disagreeing. The respondents believed that these systems have managed to result in the staffs being more motivated with their work, having higher morale and better productivity in producing more results in their work. This may not be limited to only new student recruitment, but also to the core and non-core aspects of the employees' responsibilities.

When it comes to the aspect of improving the skills and abilities of staffs, only 55% strongly agreed to this statement, compared to 37% agreeing, 6% neutral, 2% disagreeing majority of agrees on this statement. This may be due to some respondents may not be too believing in the sense this initiative as being able to improve the skills and abilities of staffs.

Only 31% of the respondents strongly agreed to the statement that the reward systems are reducing staff turnover. This is followed by an increasing 36% being agreeing, 18% being neutral, 6% disagreeing and 11% strongly disagreeing. The respondents may be of the opinion that the reward systems are not the sole determination of staff turnover, and that some other factors may be in play too. They believed that, even with a perfect reward management system but with loopholes present in other aspects such as leadership of the management, the nature of jobs, other monetary and non-monetary means may not necessarily mean low staff turnovers.

The same situation also applies in the aspect of improving morale among the staffs. Around 43% strongly agreed to this statement, followed by 36% agreeing, 12% being neutral, 6% disagreeing and 3% strongly disagreeing. The respondents may believe that, the reward systems are not the sole determining factor that influences the morale improvement of the staffs. There may too be other factors that are influencing the morale of staffs.

A whopping 94% of the respondents strongly agreed that, the overall costs in student recruitments have been reduced through these reward initiatives. Only a mere 4% agreed to this statement, and a 1% neutral and disagreeing to this statement. This showed that this reward system has been proven to be able to reduce student recruitment costs as compared to other methods such as paid and 1% strongly disagreeing. However, there are still a advertising. The respondents believed that word of mouth advertising, done in this sense, is the cheapest and more effective than other types of advertising methods. They opined that other more expensive methods such as social media, newspaper, magazines, radio and televisions may be more expensive but yet not able to produce the kind of results that word of mouth advertising can produce.

Sixty-three percentage of the respondents strongly agreed to the statement that, such reward systems are mutually beneficial to both the staffs and students of PICOMS. This is
followed by 25% being merely agreeing, 8% being neutral, and another two percentage being disagreeing and strongly disagreeing respectively. The respondents find these initiatives as being able to produce win-win situations for both the staffs and students. For the staffs, they get rewarded both financially and non-financially. As for the students, they will get more personalised services from the employees and are able to make better decisions on their courses and their future careers.

When it comes to reducing absenteeism among the staffs, only 31% strongly agreed to this statement, followed by 36% agreeing, 18% neutral, 6% disagreeing and 11% strongly disagreeing. They may not believe the reward systems being the sole contributor in reducing the staffs' absenteeism. Other factors may be influencing the same.

Sixty-eight percentage of the respondents strongly agreed that the reward systems implemented will be able to improve the staffs' loyalty towards the institution. This is followed by 29% agreeing, 2% neutral, and 1% disagreeing. It seemed that the implemented systems have been proven to be able to keep the employees of PICOMS to stay longer with the organisation. The systems are able to retain them longer in addition to encourage the employees to give their very best to the organisation. This will consequently result in improved productivity, performance and ultimately increased profitability for the institution.

Only 33% respondents strongly agreed to the statement that, teamwork among the staffs will be improved. This is followed by a higher 38% being agreeing to this statement, then a 2% and 1% being neutral and disagreeing respectively. This shows that, the initiatives implemented will be able to improve and foster better employees' teamwork, but there may be other determining factors that are influencing this as well. Even with a perfect reward management system, but less than perfect systems elsewhere, teamwork may not be able to be fully optimised.

Forty six percentage of the respondents strongly agreed to the statement that, such reward systems actually encourages the employees to think out of the box towards becoming more creative and innovative in solving problems. This is followed by 33% in merely agreeing, 7% being neutral, 8% disagreeing and 6% strongly disagreeing. The majority agreed that these initiatives do in fact encourages the staffs to continuously think of better ways to recruit new students, which is a good way of improving their overall productivity.

When it comes to being able to recruit and retain quality top students which in turn improve the performance of PICOMS, 46% strongly agreed to this statement, followed by disagreeing and strongly disagreeing respectively. This shows that the initiatives implemented are able to truly produce high quality students, as the recruited students would be serious about their studies and future careers as an overall. And when the produced graduates are getting better in their quality and employability as a whole, this will improve the performance of PICOMS as a quality educational service provider in Malaysia.

Last but not least, only a mere 4% of the respondents believed the current reward system is good enough. This is followed by 7% agreeing, 14% being neutral, 56% disagreeing and 18% strongly disagreeing. This showed that the respondents believed that more reward systems can be implemented in addition to the current ones. They opined that, the present systems can be further improved and enhanced in various ways; and if these can be sustained, will be able to leverage and amplify the effectiveness of the systems.

V. CONCLUSIONS

The findings of this paper are consistent with the researches done by other authors as mentioned above.

As a whole, the reward systems being implemented by the management of PICOMS are seen to be effective enough to achieve what the systems are meant to be achieving. However, there can be more rooms for improvements in adopting more types of reward systems, should the management aim to better leverage the effectiveness of the reward systems.

For future studies, the researcher recommends in introducing specific new initiatives in the 35% agreeing, 12% neutral, 6% and 5%

REFERENCES


AUTHORS

First Author – Datuk Dr Mahamad Zubir bin Seeht Saad, DBA, R. PH. MMPS, B. Pharm (Hons) MBA, Pusrawi International College of Medical Sciences, datukzubir@picoms.edu.my.
Appendix 1 – Survey form used

The Effectiveness Of Reward System In Perlis International College of Medical Sciences (PICOMS) Malaysia

Summary: PICOMS has introduced a reward system whereby staffs or employees are rewarded when they managed to recruit or introduce students to join the institution. This survey is done to investigate the effectiveness of such a reward system.

Please tick one box from 1 to 5 in the tables beside.

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Do you perceive the reward system in PICOMS as being effective in attaining its objectives?

1. The number of students every semester is increasing
2. The recruited students are more effective and efficient
3. Improving relationships between staffs and students
4. Increasing motivation among staffs
5. Improving the skills and abilities of staffs
6. Reduce staff turnover
7. Improve morale among staffs
8. Reduce overall costs in recruiting students
9. Mutually beneficial to both the staffs and PICOMS
10. Reducing absenteeism among staffs
11. Improve the loyalty of staffs towards PICOMS
12. Increase teamwork among the staffs
13. Encourage employees to “think out of the box” to become more creative and innovative in solving problems
14. Able to recruit and retain quality top students, which in turn improve the performance of PICOMS

Do you feel the current reward system is good enough?

Appendix 2 – Chart of the responses
Appendix 3 – Results in numbers

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you perceive the reward system in PICOMS as being effective in attaining its objectives?</td>
<td>145</td>
<td>32</td>
<td>9</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>The number of students every semester is increasing</td>
<td>132</td>
<td>32</td>
<td>9</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>The recruited students are more effective and efficient</td>
<td>151</td>
<td>18</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Improving relationships between staffs and students</td>
<td>149</td>
<td>21</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Increasing motivation among staffs</td>
<td>158</td>
<td>13</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Improving the skills and abilities of staffs</td>
<td>98</td>
<td>64</td>
<td>32</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>Reduce staff turnover</td>
<td>76</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Reduce overall costs in recruiting students</td>
<td>175</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mutually beneficial to both the staffs and PICOMS</td>
<td>114</td>
<td>45</td>
<td>15</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Reducing absenteeism among staffs</td>
<td>11</td>
<td>64</td>
<td>12</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>Improve the loyalty of staffs towards PICOMS</td>
<td>122</td>
<td>52</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Increase teamwork among the staffs</td>
<td>10</td>
<td>68</td>
<td>24</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Encourage employees to “think out of the box” to become more creative and innovative in solving problems</td>
<td>33</td>
<td>60</td>
<td>12</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Able to recruit and retain quality top students, which in turn improve the performance of PICOMS</td>
<td>75</td>
<td>83</td>
<td>22</td>
<td>31</td>
<td>3</td>
</tr>
<tr>
<td>Do you feel the current reward system is good enough?</td>
<td>8</td>
<td>13</td>
<td>25</td>
<td>103</td>
<td>21</td>
</tr>
</tbody>
</table>

Appendix 4 – Results in percentages

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you perceive the reward system in PICOMS as being effective in attaining its objectives?</td>
<td>82.78%</td>
<td>11.67%</td>
<td>3.33%</td>
<td>1.67%</td>
<td>0.56%</td>
</tr>
<tr>
<td>the number of students every semester is increasing</td>
<td>23.33%</td>
<td>17.78%</td>
<td>5.00%</td>
<td>2.78%</td>
<td>1.13%</td>
</tr>
<tr>
<td>The recruited students are more effective and efficient</td>
<td>31.89%</td>
<td>10.00%</td>
<td>2.78%</td>
<td>3.28%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Improving relationships between staffs and students</td>
<td>62.78%</td>
<td>11.67%</td>
<td>3.33%</td>
<td>1.67%</td>
<td>0.56%</td>
</tr>
<tr>
<td>Increasing motivation among staffs</td>
<td>87.78%</td>
<td>7.12%</td>
<td>2.78%</td>
<td>2.22%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Improving the skills and abilities of staffs</td>
<td>55.00%</td>
<td>16.67%</td>
<td>5.00%</td>
<td>1.67%</td>
<td>1.13%</td>
</tr>
<tr>
<td>Reduce staff turnover</td>
<td>10.56%</td>
<td>35.56%</td>
<td>17.38%</td>
<td>9.56%</td>
<td>10.56%</td>
</tr>
<tr>
<td>Improve morale among staffs</td>
<td>43.13%</td>
<td>16.11%</td>
<td>11.67%</td>
<td>5.00%</td>
<td>3.33%</td>
</tr>
<tr>
<td>Reduce overall costs in recruiting students</td>
<td>94.44%</td>
<td>4.44%</td>
<td>0.56%</td>
<td>0.56%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Mutually beneficial to both the staffs and PICOMS</td>
<td>63.13%</td>
<td>20.56%</td>
<td>8.12%</td>
<td>1.67%</td>
<td>1.67%</td>
</tr>
<tr>
<td>Reducing absenteeism among staffs</td>
<td>10.56%</td>
<td>35.56%</td>
<td>17.38%</td>
<td>9.56%</td>
<td>10.56%</td>
</tr>
<tr>
<td>Improve the loyalty of staffs towards PICOMS</td>
<td>57.78%</td>
<td>28.57%</td>
<td>2.22%</td>
<td>1.13%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Increase teamwork among the staffs</td>
<td>33.33%</td>
<td>27.78%</td>
<td>15.63%</td>
<td>6.30%</td>
<td>7.22%</td>
</tr>
<tr>
<td>Encourage employees to “think out of the box” to become more creative and innovative in solving problems</td>
<td>46.11%</td>
<td>22.22%</td>
<td>6.67%</td>
<td>9.22%</td>
<td>5.56%</td>
</tr>
<tr>
<td>Able to recruit and retain quality top students, which in turn improve the performance of PICOMS</td>
<td>41.67%</td>
<td>15.00%</td>
<td>12.22%</td>
<td>5.11%</td>
<td>5.00%</td>
</tr>
<tr>
<td>Do you feel the current reward system is good enough?</td>
<td>4.44%</td>
<td>7.78%</td>
<td>13.89%</td>
<td>56.11%</td>
<td>16.33%</td>
</tr>
</tbody>
</table>
The Role of accountability in combating corruption in Local Government Authorities in Tanzania: Case Study of Mbozi District Council

Audronicus Kivyiro and Samwel Obino Mokaya

DOI: 10.29322/IJSRP.8.4.2018.p7669  
http://dx.doi.org/10.29322/IJSRP.8.4.2018.p7669

Abstract: The devolution that was done in Tanzania in the 1990s brought several challenges, one of them being grand corruption in the local governments. The purpose of this research was to investigate the role of governance in combating corruption in local government authorities in Tanzania using Mbozi district council and focusing on accountability, transparency, and integrity and influence leadership. The sample of sixty one (61) respondents drawn from a target population of 72; comprising of the Council Management Team, Councilors and the Members of the Ward Development Committees from four wards was used. The data gathered were both quantitative and qualitative obtained by using questionnaires and interview guide respectively. The collected data was analyzed both quantitatively and qualitatively. Quantitative data was analyzed using descriptive (mean and percentages) and inferential statistics (Pearson Correlation Coefficient). Thematic analysis was used to analyze the qualitative data. The results revealed that there was a significant correlation between the roles of accountability (0.453) and combating of corruption. The study suggests more improvement in the accountability in Mbozi district council. To achieve this there should be programmes for empowering citizens to demand for more accountability from their local government.

Key Words: Governance, accountability, integrity, transparency and transparency

Background of the Study

According to Kofi Anan (2004), corruption is an insidious plague that has a wide range of corrosive effects on societies. Corruption can be defined as the abuse of public office for private gains (TI, 2009). It includes practices such as bribery, fraud, misallocation of public funds and failure to manage efficiently the public resources. Corruption is known to cause underdevelopment as Public funds are misused or diverted for private purposes which later undermine all the efforts made by the government to alleviate poverty. Corruption ranges from small amounts of cash given to bureaucratic official called petty corruption to the embezzlement of public funds in state coffers and in projects poorly done which is called grand corruption. Whether petty or grand the cost of corruption is unbearable. Corruption is known to destroy the governance systems a situation which is called State Capture.

Various studies have shown that local governments stand a higher chance of being more vulnerable to corruption than the central government because of lack of anti - corruption architectures for preventing detecting and punishing corruption, lack of transparency mechanisms, failing to realize the incentive of citizens participation in governance and having more political actors due to the closeness of the government with other groups or stakeholders with vested interests such as the business community (pwc, 2014). Corruption in local government Authorities is a global phenomenon. In Kent County Council (KCC) the head of energy procurement for the Local Authority South East Region, an organization known as LASER was found involving in corruption and in Austraria in the years between  2000 and 2009 there had been 84 investigations on corruption and misconduct in local government authorities  (TI,UK, 2013; Purcell, 2010).

Africa has not been spared by the incidences of corruption in local governments. In Nigeria and South Africa cases of corruption in local government which involved diversion of funds, misusing the funds and ghost workers on local government payroll were reported (Ayodele, 2016, CW, 2013, Diko, 2016). Foreexample in 2010 a former chairman of the Ikeme local government in Ogun state Nigeria chief Adegba Otemula and Obafemi Owode as well as Mr. Akeem Adesina were being investigated over the diversion of 30billion Naira. In 2013 the City of Johannesburg had a scandal of misusing R1.25-billion in a tender for electricity meters. Also the Deputy Minister of Cooperative Governance and Traditional Affairs in South Africa Andries Nel said that at least 200 municipal officials have been arrested for fraud and corruption in 2015. In Kenya corruption allegations in the counties seem to be distorting the achievements which have been registered because of decentralization (pwc, 2014). For example the governor of Kisumu County was accused of spending over $208,000 on hotel accommodation while his official residency was under renovation in 2015 whereas in Bungoma County the procuring of ten wheelbarrows was done at $10,300 a price that is ten times than the actual price. These are bad signals of rampant corruption that exist in local governments in Africa.

In Tanzania local government authorities are not spared from corrupt practices. Many development projects that are executed by the local government authorities are in most cases reported to be below standard. The report of Controller and Auditor General

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www.ijsrp.org
Corruption in local government authorities may take various forms. However, many corrupt practices in the local governments are due to collusion between the political elites and the public servants, collusion with the external and internal auditors as well as supervisory Ministries, ghost workers where fictitious names of workers are inserted in the payroll and inflated prices as well as tour payments (Ayodele, 2016). Recently in Tanzania in the whole country about 1000 ghost workers were removed from the payroll (URT, 2017). Many of these were in the local government authorities and Mbozi District Council had 31 of ghost works removed from the payroll.

Corruption has several causes ranging from individual character and the organizations character in which it flourishes, these are termed as the demand and the supply side. There is linkage between governance and corruption since governance makes a reference to the manner in which governments discharge their functions. Poor governance perpetuates corruption (Wolf, 2000). Among the causes of corruption are regulations, characteristics of various systems, bureaucratic traditions, wages of public officials, systems of penalty to culprits, institutional controls, lack of transparency and the examples set by leaders (Tanzi, 1998).

Corruption can also be represented in a mathematical relationship by using the governance factors of monopoly, discretion and accountability as \( C = M + D - A \) that is corruption equals monopoly (M) plus discretion (D) minus accountability (A) (Klitgaard, 1998). This formula gained a lot of acknowledgement worldwide as it captured the main root causes of corruption and was later to be modified by UNDP adding other governance factors of integrity and transparency through its program called enhancing AIT (UNDP, 2003). The formula thus became \( C = (M + D) - (A + I + T) \). This, formula strengthens the theory that corruption is primarily a failure in governance (Jenny Balboa, 2006).

The word governance has its origin in the Greek language and it refers to steering, therefore it is a complex mechanism involving various institutions, systems, structures, processes, procedures, practices, relationships and the leadership behavior in the exercise of political, economic, and managerial or administrative authority in the running of public or private affairs (Kauzya, 2003). The United Nations Development Programme (UNDP, 1997) policy paper, defined governance as “the exercise of economic, political and administrative authority to manage a country’s affairs at all levels where as World Bank defined governance as the method through which power is exercised in the management of a country’s political, economic and social resources for development (WB, 1993; UNESCO, 2006).

Combating corruption requires that the root causes of it are attacked first. The good strategy for combating corruption cannot avoid the reforms of the state the reason being, certain roles and processes of states create a fertile ground for corruption (Tanzi, 1998). Several studies have demonstrated that decentralized local governance since it breaks monopoly and strengthens accountability by involving citizens in monitoring of government performance and demanding for correct actions by their local government can help in combating corruption (Shah, 2006). However if the structures of governance and citizen empowerment lacks in the local governments may lead to state capture by few elites in the local governments.

Maintaining the definition of governance as an act of steering it is important to understand what local governance would be. According to Kauzya, what determines local governance is the extent to which the local community is involved in the steering that is in determining the direction, according to their needs, problems, and priorities and hence in this sense governance ceases to be a matter of government only hence local governance refers to the exercise of governance at community level (Kauzya, 2003). This calls for a strategy to combat corruption in the local government that put the participation of citizens at the Centre of the battle.

Fighting corruption at the local government by enhancing governance can be the best way to curtail the vice. In United Kingdom for example the National Fraud Office in 2011 introduced a program known as Fight Fraud Locally (FFL) as a counter fraud strategy for local authorities (GOV.UK, 2016). Anticorruption programmes at local level given its small size and the closeness to citizens allows better adaptation to international standards (Asis, 2000). In Europe Transparency International has registered success in the fight against corruption at the local government level by informing the public that is raising their awareness about the problem and making them participate in the fight against corruption. Transparency International has also established the Advocacy and Legal Advisory Centre (ALACS) at the local levels (Elers et al., 2010).

Local government is any unit or entity beneath the central government in a unitary system (or beneath the level of state government in a federal system (Nuno Ferreira da Cruz, 2015). It is a sub – national semi-autonomous level of government discharging its functions in a specificities geographical area be it an urban setting, rural setting a village or a suburb thus they are the forms of governments which are closest to the people (Mongi, 2015). Local governments are important avenues both politically and economically. They help in the provision of services particularly those in the periphery parts of the country and the also provide a forum for democratic participation of citizens in governance through discussion and decision making of matters affecting them as well as closer interaction between citizens and their leaders (URT, 2017).

The World Bank explains accountability as ensuring actions and decisions taken by public officials are subject to oversight so as to guarantee that government initiatives meet their stated objectives and respond to the needs of the community for which they are
meant to be benefiting, thereby contributing to better governance and poverty reduction. (WB, n.d.). These explanation actually is all about the relationship that should exist between the stakeholders. Accountability is enhanced through rules governing how representatives should behave and through processes that monitor their compliance, require them to justify their actions and provide a means of redress if they fail to act as they should (DFID, 2013). It is the Obligation, or responsibility of a person or organizations or entities to explain, answer, justify, and defend their actions or what they have done to another party who will observe, evaluate, and scrutinize that performance and they can give feedback, including reward and punishment. (Selaratana, 2009).

It is also a willingness to accept responsibility for our actions which is brought by clarity in what is expected. (PAYH, 2013, Office of the Auditor General of British Columbia, 2008). Therefore accountability is about relationships that should exist among stake holders. For local governments both internal and external accountability are important because Local Governance have various key stake holders. These stake holders include the Central governance, local government authorities, Civil Societies, Business community and International Non-Governmental organizations (INGO) and the local community itself. Therefore it is important to undertake key stakeholders and key player’s analysis to be able to recognize who are the stakeholders in the local governance (Kauzya, 2003.)

The accountability mechanisms put for the local government authorities in Tanzania which include submission of financial reports, internal auditing and external auditing, ministries inspection and the auditing of the Public Procurement Regulatory agencies all fall on the supply side of accountability commonly referred to as vertical accountability. To have an effective anticorruption through accountability there should be a horizontal accountability that is various forms of civic engagement through civil society organizations to demand accountability which is referred to as social accountability (Makuba, 2013). It is the requirement that citizens and other government agencies have entry point to elicit the proper monitoring of the local government activities (Nuno Ferreira da Cruz, 2015).

**Problem Statement**

Tanzania aims at becoming a middle income economy and a semi- industrialized country by 2025. Five Years Development Plan (FYDP) 2016/17 – 2020/21 puts corruption as a second challenge towards realization of the dreams envisaged within the Plan (URT, 2016). Decentralization process has made the Local Government Authorities become the implementing organ of many of the Government functions (URT, 2017). Therefore the existence of rampant corruption in the Local Government Authorities becomes the stumbling block towards the success of the implementation of the five years development plan.

There have been many efforts to deal with the issues of corruption in Tanzania since independence. The National Anti-Corruption and Action Plan (NACSAPI was developed in 1999 to 2010 which had its second phase commonly known as NACSAP II running from 2011 to 2016. The research conducted by REPOA found that despite some registered success in the local government reforms in Tanzania corruption was still perceived as a problem in local governments (Tidemand & Msami, 2010).

Many studies on the role of governance in combating corruption have focused on National Government but little has been done to assess the challenges of governance at the local level. This research was therefore conducted to examine the role of governance in combating corruption in local government authorities in Tanzania, with Mbozi District Council as the case study.

**Purpose of the Study**

The purpose of the study was to determine the role of accountability in combating corruption in local government authorities in Tanzania.

**Research Methodology**

This study used the case study research design. Case study design allowed the researcher to selects a small geographical area and investigate the matter closely. The Study used a sample size of 61 respondents drawn from a population of 72 people. Mixed sampling techniques involving both random sampling and purposive sampling was used. Both quantitative and qualitative data were collected. Quantitative data was collected by using the questionnaire with closed ended questions whereas qualitative data was obtained through key informant interview. Reliability of the questionnaire was obtained by calculating a Cronbach Alpha where the value obtained was 0.859. Data was analyzed both quantitatively using descriptive and inferential statics where by descriptive statistics involved determination of mean, percentages and correlation whereas inferential statistics employed multiple regression analysis and ANOVA.

**Results and discussion.**
Response Rate
This study received a response rate of 90% whereas 68.01% were male and 31.91% were female. Majority of the respondents 59.57% were of the age between 38 and 57 followed by 25.54% who were youth of the age between 18 and 37. Those above 58 years of age were 14.89%.

The Role of accountability in Combating Corruption in local government authorities

(a) Internal (Horizontal) Accountability

Seven attributes of internal accountability to mention capacity of oversight committees, number of internal auditors, independence of the internal unit, Management reaction on the findings of the internal audit unit, ability of the citizens to hold accountable their leaders and citizens participation in the following up the performance of the council which was measured as participation of citizens in planning, monitoring and evaluation. The Mean for each of the attributes was computed and where the lowest was 1 for very much disagree and the highest was 5 for very much agree. The results obtained were as shown in Table 1.

<table>
<thead>
<tr>
<th>S/N.</th>
<th>Attributes</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The oversight committees have the capacity to scrutinize the financial reports presented before them</td>
<td>3.85</td>
</tr>
<tr>
<td>2</td>
<td>The number Internal Auditors in the council is adequate to audit regularly all the council accounts and projects</td>
<td>3.04</td>
</tr>
<tr>
<td>3</td>
<td>The Internal Audit Unit is independent enough to be able to unearth the financial mismanagement/corruption in the council</td>
<td>3.30</td>
</tr>
<tr>
<td>4</td>
<td>The management take seriously the findings/recommendations from the internal audit and oversight committees</td>
<td>3.32</td>
</tr>
<tr>
<td>5</td>
<td>There are laid down procedures that give chance to hold accountable their leaders when there are scandals of corruption within the council</td>
<td>3.45</td>
</tr>
<tr>
<td>6</td>
<td>There are civil society organizations within the district which are giving awareness to the citizens on their role to hold the leadership accountable</td>
<td>3.49</td>
</tr>
<tr>
<td>7</td>
<td>The citizens participate fully in the planning, monitoring and evaluation of all activities of the district council</td>
<td>2.94</td>
</tr>
<tr>
<td></td>
<td><strong>Overall Mean (N= 47)</strong></td>
<td><strong>3.34</strong></td>
</tr>
</tbody>
</table>

According to the results some attributes were high above the overall mean. The oversight committees having the capacity to scrutinize was rated at the mean of 3.85, followed by presence of civil society organizations within the district that give awareness to citizens on their rights to hold leaders accountable rated at the mean of 3.49 and then presence of the laid down procedures to hold leaders accountable rated at the mean of 3.45. These findings are consistent with the popular view that accountability is ensured when the actions and decisions of public officials are subject to oversight scrutiny and that it is enhanced when there are rules governing how the peoples representatives monitor the compliance and decisions of public officials and the presence of civil societies that create the organized citizenry who able to demand accountability from the government (DFID, 2013, WB, 1997, REPOA, 2008).

The other attributes were below the overall mean whereby the management taking seriously the recommendations from the internal audit unit led with the mean of 3.32 followed by independence of the internal audit unit with the mean of 3.30 and presence of enough internal auditors with the mean of 3.04. The scores though below the overall mean but they are all above the expected average of 2.5 which imply that the aspects of internal auditing within the council play a great role in the combating of corruption, however as found in the study conducted by (Mkenda, 2013) this role was being undermined by the presence of political and bureaucracy in the public sector which tend to overlook the inspection powers given to the internal auditors.

Lastly citizen’s participation in the planning was ranked low with the mean of 2.97 implying that there was low citizen’s participation in Mbozi district Council. The findings contradict with the response from the interview who contended that in Mbozi district council citizens from the grass roots participated fully in the Planning, monitoring of the Council activities. The interviewee had this to say “the planning and budgeting procedure start at the village level where the citizens suggest their priorities which are taken on board when the district budget is compiled”.

The overall mean value of 3.34 which was obtained for the attributes of internal accountability suggesting a weakness in the internal accountability mechanisms. These findings are in congruence with the findings by (REPOA, 2008) who found that accountability within the councils was still weak mainly citing the reasons to be little awareness of the citizens of the mechanisms
provided for them to enforce accountability and the councilors not grasping the powers given to them by law. This findings is further found in the responses of the interviewee who said “Despite the presence of the good system of accountability the weakness are mainly due to the councilors not putting ahead the wider interests of the council but their personal interest of reaping money by threatening the council employees who are suspected of being corrupt instead of taking action against them. They therefore end up protecting the corrupt officials who bribe them”.

(b) External (Vertical) Accountability

The attributes that were studied under external accountability in the councils were the presence of the external accountability framework, timing of the external agencies in executing their role as far as combating of corruption is concerned and whether the management take seriously the recommendations of the external accountability bodies. The findings are as shown in Table 2.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Attribute</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>There is an external accountability framework within the council that involve the CAG, PPA and PCCB</td>
<td>3.45</td>
</tr>
<tr>
<td>2</td>
<td>The work of these external accountability bodies comes when mismanagement has already occurred hence helps not to combat corruption</td>
<td>3.26</td>
</tr>
<tr>
<td>3</td>
<td>The management do not take seriously the recommendations from these external accountability agencies</td>
<td>2.94</td>
</tr>
<tr>
<td>4</td>
<td>Some of these accountability institutions have no offices within the council areas</td>
<td>3.11</td>
</tr>
<tr>
<td></td>
<td><strong>Overall Mean (N= 47)</strong></td>
<td><strong>3.19</strong></td>
</tr>
</tbody>
</table>

The findings show that the presence of the external framework of accountability which involves bodies such as CAG, PPRA and PCCA was rated at 3.45 which implies that the mechanism existed. However, the work of these bodies coming after the mismanagement had occurred was rated at 3.26 implying that they were doing a postmortem job; this was followed by lack of offices to some of these external accountability bodies within the district rated at the mean of 3.11. The findings are consistent with the findings from the interviewee who noted that many of these organizations were seen to be working following up the mismanagement and PCCB was cited as leading among those following up the already happened public resource mismanagement. The interviewee had this to say ”Most of these institutions especially the PCCB follow only when there is the mismanagement, this is the time you see them busy looking for documents and interrogating the council officials, the CAG Audits once a year unless something special has happened likewise the PPRA they seldom visits the Council”. The management taking seriously the recommendations of the external accountability bodies was rated at 2.94 implying that the Management was not motivated to work on the recommendations provided to them by the external accountability institutions.

The results showed that the overall mean was 3.19 indicating that more than half of the respondents agreed that there was the external accountability framework that include agencies such as CAG, PCCB and PPRA exists and functions but it leaves a desire to do more than what it is currently done in order to combat corruption, they also agreed that these agencies have not been able to bring an end to corruption. These findings are in agreement with the findings of Aiko (2015) on the fight against corruption where Citizens indicated their dissatisfaction with the efforts in the fight against corruption despite the presence of accountability organs such as CAG, PCCB and PPRA.

The Study also conducted the Correlation analysis between the aspects of accountability and the strategies to combat corruption with the aim of determining the influence of each of the aspects of accountability on the methods used to combat corruption. The results obtained were as shown in table 3.

<table>
<thead>
<tr>
<th>Aspects of Accountability</th>
<th>Strategies to Combat Corruption</th>
</tr>
</thead>
</table>
From the results it was found that presence of the internal accountability framework had varied results with the methods to combat corruption some being significantly correlated and other not significantly correlated. For instance it was positively and significantly correlated with four out of the six methods (Techniques) to combat corruption namely identifying corruption risks (0.415), empowering the community to be whistle blowers (4.00), presence of a well-built coalition of stakeholders (0.311) and punishing those found to be corrupt (0.338). It was however not significantly correlated with other two aspects though had positive coefficient which are monitoring the LGA performance (0.224) contrary to the expectation as it is expected that monitoring of the LGA performance is part of the internal accountability mechanisms, also the council engaging other agencies such as PCCB (0.228) as expected because the other agencies like PCCB are not part of the internal accountability framework.

Oversight having the Capacity to supervise and scrutinize reports from the management was positively and significantly correlate with four aspects of the techniques or strategies to combat corruption namely identifying corruption risks (0.342), monitoring the LGA performance (0.298), engaging other agencies such as PCCB (0.305) and punishing those found to be corrupt (0.297). This aspect though having a positive Pearson Correlation Coefficient was found not to be significant with empowering the community to be whistle blowers (0.082) and presence of a well-built coalition (0.280). This implies that there is no strong relationship between the capacity of the oversight committees and the community being empowered to be whistle blowers and presence of a well-built coalition of stake holders.

The internal auditor being enough to carry out the duties assigned to them was not significantly correlated with all the combating of corruption strategies though having positive coefficients. Though not significant some of the coefficients had a slightly higher value for instance identification of corruption risks (0.194), empowering the community to be whistle blowers (0.202) and engaging other agencies such as PCCB (0.117) compared to presence of well-built coalition of stakeholders (0.059), monitoring of the LGA performance (0.53) and punishing those found to be corrupt. These results show that the number of the internal auditors is not a strong factor in the combating of corruption.

The freedom of the Internal Audit Unit was not significantly correlated with all the combating of corruption strategies though having positive coefficients. Though not significant some of the coefficients had a slightly higher value for instance identification of corruption risks (0.120), empowering the community to be whistle blowers (0.135), monitoring the LGA performance (0.284)
and punishing those found to be corrupt (0.187) compared to presence of well-built coalition of stake holders (0.081), and the Council engaging other agencies such as PCCB. The results are contrary to the popular belief that a free internal audit unit will have a significant impact in the combating of corruption.

The Management taking seriously recommendations from the internal audit unit was not significantly correlated and have very low coefficients with all the strategies to combat corruption. It has however good to not that the coefficients were all positive thus indicating a weak relationship. The Coefficients were, for identifying corruption risks earlier (0.045), empowering the community to be whistle blowers (0.189), presence of a well-built coalition of stake holders (0.094), monitoring of the LGA performance (0.080), the council engaging other agencies such as PCCB (0.029) and punishing those found to be corrupt (0.080). The findings are contrary to the popular belief that the internal audit recommendations help the management to take administrative actions to prevent corruption, so it is expected that they will take seriously the recommendations.

Presence of the procedures that give chance for the citizens to hold the leaders accountable was correlated with all the strategies used to combat corruption. The findings showed that some had high significance than the other. For instance punishing those found to be corrupt (0.490) had a high coefficient followed by monitoring of the LGA performance (0.481) and then the council engaging other agencies such as PCCB (0.477). The other coefficients were presence of a well-built coalition of stake holders (0.368) followed by identifying corruption risks earlier (0.321), empowering the community to be whistle blowers (0.302).

Presence of Civil Societies that provide awareness to citizens was significantly correlated with only two aspects namely monitoring of the LGA performance (0.420) followed by presence of the well-built coalition of stake holders (0.316). Although not significantly correlated presence of civil societies which provide awareness to the citizens had positive correlation with other aspects such as identifying corruption risks earlier (0.231) and empowering the community to be whistle blowers (0.230) which is contrary to the popular view that civil societies are good at empowering the community. The aspect of punishing those found to be corrupt (0.224) and lastly the council engaging other agencies such as PCCB (0.167) had also positive correlation coefficients though low which is not a problem as it is not the role of the civil societies to engage PCCB and punishing those found to be corrupt.

The Citizens participating in all council activities from planning, monitoring and evaluation was positively and significantly correlated with three aspects namely punishing those found to be corrupt (0.408) followed by presence of a well-built coalition (0.351) and then monitoring the LGA performance (0.329). The other aspects were not significantly correlated but had positive correlation in the order that they had the coefficients which are the council engaging other agencies such as PCCB (0.281), empowering the community to be whistle blowers (0.232) and identifying corruption risks earlier (0.194).

Presence of the external accountability framework was significantly and positively correlated with five aspects in the order of council engaging other agencies such as PCCB (0.445), identifying corruption risks (0.443), punishing those found to be corrupt (0.409), presence of well-built coalition of stake holders (0.353) and monitoring of the LGA performance (0.318). The aspect which was not significantly correlated was empowering the community to be whistle blowers (0.272). Although not significant the correlation is not very low thus indicating some relationship between them.

Accountability working in time to prevent corruption from taking place was not significantly correlated with any of the strategies to combat corruption. The aspects had low correlation coefficients which varies in strength in the order of punishing those found to be corrupt (0.201), identifying corruption risks earlier (0.173), monitoring the LGA performance (0.117), empowering the community to be whistle blowers (0.50), presence of well-built coalition with stake holders (0.018) and monitoring of the LGA performance (0.018). The findings indicated low and non-significant correlations contrary to what would be expected of the timely performance of these external accountability bodies with strategies to combating of corrupt

The Management taking seriously the recommendations of the external accountability institutions was found to correlate with only two aspects of combating corruption namely the council engaging other agencies such as PCCB (0.374) followed by identifying corruption risks earlier (0.372). Management taking seriously recommendations from the external accountability institutions was not significantly correlated with the strategies to combat corruption. Although not significantly correlated they had differing degrees of strength in the order from high to low of punishing those found to be corrupt (0.272), monitoring the LGA performance (0.259), presence of well-built coalition of stake holders (0.219) and empowering the community to be whistle blowers (0.055).
Presence of offices of accountability institutions within the council was not significantly correlated with any of the aspects of the strategies used to combat corruption and had low coefficients. The coefficients in the order of decreasing were such as the council engaging other agencies such as PCCB (0.140), punishing those found to be corrupt (0.114), empowering the community to be whistle blowers (0.077), presence of a well-built coalition of stake holders (0.045), identifying corruption risks earlier (0.013) and monitoring of the LGA performance (0.012). The findings are contrary to what is expected that the closer the offices of these external accountability bodies the more effective they would be in combating corruption.

The respondents views on the role of effective accountability in combating Corruption were also sought where they were required to rate it on the Likert scale from 1 to 5 where 1 was very low, 2 was low, 3 was somehow high, 4 was high and 5 was very high. The Percentage of the responses were plotted in the bar charts and the results are as shown in Figure 1.

![Bar Chart of Accountability](attachment:image)

**Figure 2 Role of Accountability**

The results showed that large number of respondents agreed that accountability was important in Combating corruption whereby 38.30% ranked the role of accountability as somehow high and 25.30% ranked the role of accountability as high while 17.02% ranked it at very high. Only 10.64% of respondents ranked the importance of accountability as very low and 8.51% ranked it at low. From these findings it is clear that effective accountability play an important role in combating corruption. This supports postulation that an effective anticorruption requires effective accountability which involves a horizontal form accountability that has an element of civic engagement through organized civil societies something known as social accountability as well as the engagement of other government agencies (Makuba, 2013, Cruz, 2015). Lack of effective accountability was found to perpetuate corruption in Meru district Council (Muro, 2015) and therefore role of effective accountability in combating corruption is indispensable as found in the study conducted in Nigeria on the Accountability and Anti-Corruption (Okekeocha, 2013).

The respondents were also asked to rate the effectiveness of accountability in Mbozi District Council. The opinions of the respondents were computed in percentages and then plotted in a bar chart. The results of their opinions are as shown in Figure 2.
The findings indicated that the opinion were uniformly distributed where by 36.17% were of the opinion that the level of accountability was somehow high while on both extreme of the distribution there is equal percentage of 31.9% whose opinion is either very low to low or high to very high. These findings showed that accountability in Mbozi District Council was still weak and hence not able to Combat Corruption.

### Hypothesis Testing

**Hypothesis 1:** *Accountability does not play an effective role in combating corruption in local government authorities in Tanzania.*

To test the hypothesis which states that accountability does not play an effective role in combating corruption in local government authorities in Tanzania a Pearson Correlation was used. The results of the test are summarized in table 4.4. The results show that combating of corruption had a significant and positive relationship with seven out of twelve attributes of effective accountability while had a positive and non-significant relationship with five of them. Those with significant relationship were; presence of the internal accountability framework (0.391), oversight committees capacity (0.330), presence of procedures to hold leaders accountable (0.505), civil societies give awareness to citizens (0.321), citizens participating fully in planning, monitoring and evaluation of all activities of the council (0.372), presence of the external accountability framework (0.462) and management taking seriously recommendations of external accountability bodies (0.320). Those which had a non-significant relationship were; internal auditors being enough (0.118), freedom of the internal audit unit (0.125), management taking seriously the recommendations from the internal audit (0.006), timely working of the external accountability bodies to prevent corruption (0.089), and external accountability bodies having offices in the district premises(0.020). Something of importance to note here is that presence of the laid down procedure to hold the leadership accountable had the highest significance, followed by presence of external framework, presence of the internal frameworks, citizens participation in all activities of the council, oversight having the capacity, presence of civil societies giving awareness to citizens and management taking seriously recommendations from the external accountability bodies. For those which were not significant; management taking seriously the recommendations of the internal audit had the lowest significance followed by external accountability bodies having offices in the district premises, external accountability bodies working in time to prevent corruption, presence of enough internal auditors to carry out their duties and the freedom of the internal audit unit. The overall correlation between accountability and combating of corruption was established at 0.453. The results imply that effective accountability had a positive and significant role in combating corruption in the local government authorities in Tanzania, thus the hypothesis is rejected.
Table 4.4 Pearson Correlation of Accountability with combating of Corruption.

<table>
<thead>
<tr>
<th>Accountability Attributes</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is an internal accountability framework within the council</td>
<td>.391**</td>
</tr>
<tr>
<td>Oversight Committees have the Capacity</td>
<td>.330*</td>
</tr>
<tr>
<td>Internal Auditors are enough to carry out the duties</td>
<td>.118</td>
</tr>
<tr>
<td>Internal Audit Unit is free to carry out its duties</td>
<td>.125</td>
</tr>
<tr>
<td>Management take seriously recommendations of Internal Audit</td>
<td>.006</td>
</tr>
<tr>
<td>There are laid down procedures to hold accountable their leaders</td>
<td>.505**</td>
</tr>
<tr>
<td>CSO to give awareness to the citizens on their role to hold the leadership accountable</td>
<td>.321*</td>
</tr>
<tr>
<td>The citizens participate fully in the planning, monitoring and evaluation of all activities of the district council</td>
<td>.372</td>
</tr>
<tr>
<td>There is an external accountability framework within the council</td>
<td>.462**</td>
</tr>
<tr>
<td>External Accountability institutions work in time to prevent Corruption</td>
<td>.089</td>
</tr>
<tr>
<td>Management take seriously recommendations from External Accountability Institutions</td>
<td>.320</td>
</tr>
<tr>
<td>External accountability bodies have their offices in the district</td>
<td>.020</td>
</tr>
<tr>
<td>Overall Effectiveness of accountability</td>
<td>.453**</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
* . Correlation is significant at the 0.05 level (2-tailed).

**Conclusions**

According to the findings of this study, it was concluded that there was in place a governance system in Mbozi District Council provided by the laws that establish and direct the practices of running the Local government Authorities in Tanzania. Effectiveness of accountability within the local government was measured through internal (horizontal accountability) and external (vertical accountability). The role of internal framework of accountability within the council which involved presence of the laid down procedures to hold leaders accountable, citizens participation in the all stages of planning up to evaluation of council activities, capacity of the oversight committees and the presence of civil society organizations to empower citizens played a significant role in combating corruption while for external accountability its presence and the council management taking seriously their recommendations played a role in combating corruption. There was a strong positive relationship between accountability and combating of corruption. There was a significant positive correlation between accountability and combating corruption, implying that effective accountability played a great role in combating corruption.

**Recommendations**

The standing committees of the councils which are the oversight institutions established by the local Government Act should be empowered through capacity building. The PO – RALG should have programmes for training councilors in important issues of governance and their roles to oversee that the employees of the council and other leaders are showing stewardship in the performance of their duties.

Citizens need to be organized in their communities and get empowered. The villages and Wards are the best avenues where many citizens can be reached. When the citizens despite their low level of education will develop the understanding of what to expect from their leaders accountability will be effective. The Civil Society Organizations (CSO) that deal with the issues of anti-
corruption should take a deliberate responsibility of descending to rural areas to empower the common citizens through the right based approach to demand accountability from their local governments.

The agencies of accountability such as the CAG, PPRA and PCCB must take a proactive role in prevention through follow up of resources from the point of origin to the last point where it will be used is the best way to combat corruption.

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