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Extreme Rainfall Prediction Using Bayesian Binary Quantile Regression

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Abstract - Extreme rainfall can cause flood and bring bad impact to the agricultural sector. Indonesia has extreme rainfall in several region such as West Java, where the lowland area is at the northern region and the highland area is at the southern. The Global Circulation Models (GCM) output data can be used to get informations about rainfall. Statistical downscaling (SD) is the technique which can be used to analyze the functional relationship between local scale data (rainfall) and global scale data (GCM output) using statistical method. The extreme rainfall can be analyze using quantile regression in SD to measure the effect of explanatory variables not only at the center but also at the two tails of the data distribution. Bayesian Binary Quantile Regression (BBQR) is an extension of quantile regression where the dependent variable scale is binary. BBQR is based on asymmetric Laplace distribution, so that the parameter estimation of the posterior distribution uses the Markov Chain Monte Carlo (MCMC) method. The multicollinearity in GCM output data can be overcome by adding the Least Absolute Shrinkage and Selection Operator (LASSO) penalty in the model. The BBQR model resulted in the good extreme rainfall prediction and the prediction at lowland area was more accurate than that at the other land area.

Index Terms - Bayesian Binary Quantile Regression, LASSO, MCMC, Statistical Downscaling

I. INTRODUCTION

Rainfall is a climate factor that can affect for human life. Extreme rainfall can cause flood and bring bad impact to the agricultural sector. Indonesia has extreme rainfall in some areas such as West Java, where the northern region of West Java is a lowland area while the southern part is a highland area. The difference in altitude resulted in a difference rainfall intensity [9], so accurate analysis was needed for predicting extreme rainfall to reduce the negative impact on the agricultural sector. Global Circulation Models (GCM) output data is used to obtain information about rainfall. But GCM output data is still a global-scale data that has large dimensions so statistical downscaling techniques can be used to analyze the functional relationship between local-scale data (rainfall) and global-scale data (GCM output) using statistical method.

Extreme rainfall can cause the probability distribution of the rainfall to be far from Gaussian [12]. Quantile regression is a method that can be used to analyze asymmetric data [7]. Quantile regression can measure the effect of explanatory variables not only at the center but also at the two tails of the data distribution. Yu and Moyeed (2001) popularized the Bayesian method on quantile regression using sample information and prior distribution to obtain posterior distribution. They suggest that Bayesian quantile regression is based on asymmetric laplace distribution, so that to obtain estimated parameter from posterior distribution using Markov Chain Monte Carlo (MCMC) method. The famous MCMC methods are Metropolis-Hasting [14] and Gibbs sampling [8].

Benoit and Van den Poel (2012) developed quantile regression for dichotomus/binary response variables. They developed the regression using the Bayesian approach through the Metropolis-Hasting algorithm to estimate the parameters of binary quantile regression [2]. Alhamzawi et al. (2013) made improvements to previous journals by developing quantile binary regression with the addition of LASSO penalties using Bayesian analysis through gibbs sampling algorithms [1].

Many studies of statistical downscaling using quantile regression have been done. Wigena and Djuraidah (2014) estimates extreme rainfall using quantile regression with Principle Component Analysis as dimensional reduction [13]. Based on Zaikarina et al. (2016), quantile regression with LASSO penalty was better to predict extreme rainfall than quantile regression with ridge penalty [15]. Hendri et al. (2019) estimated extreme rainfall in West Java using Bayesian quantile regression. The results of the study showed that Bayesian quantile regression models are accurate enough to predict rainfall in West Java compared to the quantile regression model [6]. Previous research has used continuous response as dependent variable, so that this study will predict extreme rainfall using quantile regression with binary responses namely extreme rainfall ($y_i = 1$) and not extreme ($y_i = 0$) with LASSO penalty with the Bayesian approach. The purpose of this study is statistical downscaling modeling to predict extreme rainfall using Bayesian binary quantile regression with LASSO penalty.

II. METHOD

A. Data

The dependent data in this study is secondary data from 1981 to 2009. Monthly rainfall data in West Java from BMKG are grouped based on type of land, low, medium, and high. The rainfall data in the lowlands are from 12 stations, the medium land are from 3 stations, and the highlands are from 3 stations.

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The independent variables in this study are GCM output data which is climate forecast system reanalysis (CFSR) monthly precipitation data with a grid size of 2.5°×2.5° of domain 5x8 grid based on the best domain [5]. The CFSR is a mathematical model that describes the global interaction between lands, oceans, and air issued by The National Centers for Environmental Prediction (NCEP) (https://rda.ucar.edu).

B. Procedure of Analysis

1. Grouping regions in West Java into three parts, lowland (0-200 masl), medium land (201-500 masl) and highland (>500 masl).
2. Grouping monthly rainfall in West Java becomes two types, extreme rainfall $y_1 = 1$ and not extreme $y_1 = 0$ using the measure of surprise based on the study by Manurung et al. (2018) to determine the threshold [10].
4. Split the monthly rainfall data into two parts, which the 1981-2008 data as modeling data and 2009 data as validation data.
5. Predict monthly extreme rainfall using Bayesian binary quantile regression method [1] with the following models:

$$y_i^* = x_i' \beta + \omega v_i + \psi\sqrt{\sigma v_i u_i}$$

where $\omega = 2$, $\psi = 2$, $v = [v_1 ... v_n]'$, $\nu \sim \exp(\sigma)$, $u_i \sim N(0,1)$, and $y_i = \{1, 0\}$ if $y_i$ $\geq$ threshold, else.

The LASSO penalty in quantile 0.70, 0.75, 0.80, 0.85, 0.90, 0.925, 0.95, 0.975, and 0.99 are used to obtain variables that are not multicollinearity with the following formula:

$$\min_{\beta \in S} \sum_{i=1}^{n} \rho_i(y_i - x_i' \beta') + \lambda \| \beta \|_1$$

with $\lambda \geq 0$ is the lagrange multiplier, and $\| \beta \|_1 = \sum_{j=1}^{p} | \beta_j |$ is $l_1$ LASSO penalty.

The estimate of the parameters is using the Bayes method with the MCMC (Markov Chain Monte Carlo) algorithm, gibbs sampling as follows:

a. Suppose the initiation value for $y_i^*, \beta_j, \eta^2, \zeta, \sigma, s_j, v_i, \delta$.

b. For the first iteration, do

- Generate $y_i^{(1)} \sim \pi(y_i|\beta, \eta^2, \zeta, \sigma, s, v, \delta, y)$
- Generate $\beta_j^{(1)}, \beta_j^{(1)} \sim \pi(\beta_j|y', \eta^2, \zeta, \sigma, s, v, \delta, y)$
- Generate $\sigma^{(1)}, \sigma^{(1)} \sim \pi(\sigma|y', \beta, \eta^2, \zeta, s, v, \delta, y)$
- Generate $\eta^{(1)}, \eta^{(1)} \sim \pi(\eta^2|y', \beta, \zeta, \sigma, s, v, \delta, y)$
- Generate $\zeta^{(1)}, \zeta^{(1)} \sim \pi(\zeta|y', \beta, \eta^2, \sigma, s, v, \delta, y)$
- Generate $v_i^{(1)}, v_i^{(1)} \sim \pi(v_i|y', \beta, \eta^2, \zeta, \sigma, s, v, \delta, y)$
- Generate $\delta^{(1)}, \delta^{(1)} \sim \pi(\delta|y', \beta, \eta^2, \zeta, \sigma, s, v, y)$

Repeat steps 5b as many as $m$ iterations.

d. Obtained examples that have a joint posterior distribution $\pi(y_i^*, \beta, \eta^2, \zeta, \sigma, s, v, \delta|y)$

6. The model is evaluated based on accuracy values.

<table>
<thead>
<tr>
<th>Predicted Values</th>
<th>Actual Values</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extreme (1)</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Not Extreme (0)</td>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>

Accuracy is the overall accuracy of the prediction that can be calculated with the following formula:

$$\text{Accuracy} = \frac{(A + D)}{(A + B + C + D)}$$

where,

- A : Extreme rainfall predicted to be extreme
- B : Not Extreme rainfall predicted to be extreme
- C : Extreme rainfall predicted to be not extreme
- D : Not extreme rainfall predicted to be not extreme

III. RESULT

A. Data Description

a. Rainfall

A description of rainfall data in West Java on low, medium, and highlands is presented in Figure 1.

![Boxplot of rainfall in West Java from 1981 to 2009](image)

The pattern of rainfall of each land is U shaped. In the rainy season, the intensity of rainfall has an average greater than 150 mm/month [11]. The rainy season occurs between October - May in the lowlands of West Java, while in the medium and highland of West Java the rainy season occurs every month. The intensity of rainfall on medium and highland is higher than the intensity of rainfall in lowland. Extreme rainfall has a monthly rainfall intensity greater than 400 mm/month [4]. Based on that, extreme rainfall occurs in January and February in the lowland. In medium and highland, extreme rainfall occurs in October - April. The difference of altitude results in a difference in rainfall intensity [9], so the extreme values for extreme rainfall intensity in each land are different. Therefore, to categorize rainfall into extreme and not extreme categories is using the measure of surprise (MOS) based on the study by Manurung et al. (2018) to determine the threshold [10].

b. GCM Output

GCM output data are high dimension that can be multicollinearity between the variables, so it checked by looking at the variance inflation factor (VIF) value. Based on Table 1, there are variables that have a VIF value greater than 10. It indicates that there is a multicollinearity problem.
### Table 1: The VIF value of the GCM output data

<table>
<thead>
<tr>
<th>Variable</th>
<th>VIF</th>
<th>Variable</th>
<th>VIF</th>
<th>Variable</th>
<th>VIF</th>
<th>Variable</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>2.22</td>
<td>X11</td>
<td>5.04</td>
<td>X21</td>
<td>13.99</td>
<td>X31</td>
<td>14.14</td>
</tr>
<tr>
<td>X2</td>
<td>3.10</td>
<td>X12</td>
<td>5.20</td>
<td>X22</td>
<td>12.33</td>
<td>X32</td>
<td>12.54</td>
</tr>
<tr>
<td>X3</td>
<td>3.09</td>
<td>X13</td>
<td>5.70</td>
<td>X23</td>
<td>8.32</td>
<td>X33</td>
<td>4.61</td>
</tr>
<tr>
<td>X4</td>
<td>2.58</td>
<td>X14</td>
<td>4.02</td>
<td>X24</td>
<td>5.52</td>
<td>X34</td>
<td>7.66</td>
</tr>
<tr>
<td>X5</td>
<td>2.65</td>
<td>X15</td>
<td>4.37</td>
<td>X25</td>
<td>5.41</td>
<td>X35</td>
<td>8.73</td>
</tr>
<tr>
<td>X6</td>
<td>3.29</td>
<td>X16</td>
<td>4.66</td>
<td>X26</td>
<td>8.29</td>
<td>X36</td>
<td>7.45</td>
</tr>
<tr>
<td>X7</td>
<td>2.98</td>
<td>X17</td>
<td>4.20</td>
<td>X27</td>
<td>8.00</td>
<td>X37</td>
<td>8.18</td>
</tr>
<tr>
<td>X8</td>
<td>3.44</td>
<td>X18</td>
<td>4.48</td>
<td>X28</td>
<td>10.20</td>
<td>X38</td>
<td>14.81</td>
</tr>
<tr>
<td>X9</td>
<td>3.80</td>
<td>X19</td>
<td>5.75</td>
<td>X29</td>
<td>10.27</td>
<td>X39</td>
<td>18.34</td>
</tr>
<tr>
<td>X10</td>
<td>4.63</td>
<td>X20</td>
<td>8.06</td>
<td>X30</td>
<td>7.68</td>
<td>X40</td>
<td>11.12</td>
</tr>
</tbody>
</table>

### B. Measure of Surprise

Extreme rainfall can cause the probability distribution of the rainfall to be far from Gaussian [12]. The shape of distribution below the threshold is difficult to determine from graph exploration. Histograms and plot density rainfall data for average rainfall at several stations on lands in West Java are presented in Figure 2.

![Figure 2: Histogram of rainfall (a) lowland, (b) medium land, (c) highland](image)

The three histograms have the same of a global turning point around 50-70 mm. The difference is at the local turning point on each land. Rainfall in the lowland has local turning point at 110 mm and 150 mm. In the medium land at 250 mm and 330 mm. In the highland at 210, 350 and 410 mm. These points potentially to be threshold values that will be used to categorize rainfall into extreme and not extreme in each land in West Java.

The measure of surprise (MOS) plot of rainfall for each land in West Java is in Figure 3. The MOS plot consists of several boxplots representing the number of threshold candidates on each lands. The dotted line indicates the lowest limit when the surprise starts to stabilize at 0.5.

![Figure 3: MOS plot of rainfall](image)
The estimated threshold reaches 285 mm in lowlands, while in medium and highland 462 mm. The Generalized Pareto Distribution (GPD) in the lowlands starts at 105 mm, in medium land 330 mm, and in highland 352 mm. The frequency of rainfall that has been converted into binary data above the threshold is 181 (52%) in the lowland, 97 (28%) in the medium land, and 81 (23%) in the highland. Then, this binary data is used to predict extreme rainfall in West Java using Bayesian binary quantile regression method with LASSO penalty.

**C. Bayesian Binary Quantile Regression**

The Bayesian binary quantile regression models is on quantile 0.70, 0.75, 0.80, 0.85, 0.90, 0.925, 0.95, 0.975, and 0.99 in each land. The 9 quantile points of Bayesian binary quantile regression models is intended to obtain accuracy values. For a meaningful interpretation of the predicted probabilities, the results of at least 9 quantiles should be used [3]. In general, there are several variables eliminated from the model due to LASSO penalty. Table 2 is an example of the LASSO coefficients and variables selected for the lowland at quantile 0.75.

**Table 2: LASSO coefficient and variables of BBQR in Q (0.75) in the lowland**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Interval Credibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Lower         Upper</td>
</tr>
<tr>
<td>X1</td>
<td>-11.45</td>
<td>-15.70         -2.18</td>
</tr>
<tr>
<td>X5</td>
<td>0.46</td>
<td>0.03           0.89</td>
</tr>
<tr>
<td>X9</td>
<td>7.81</td>
<td>2.16           9.68</td>
</tr>
<tr>
<td>X10</td>
<td>3.27</td>
<td>1.00           5.06</td>
</tr>
<tr>
<td>X12</td>
<td>2.48</td>
<td>1.49           3.11</td>
</tr>
<tr>
<td>X14</td>
<td>4.56</td>
<td>1.27           5.70</td>
</tr>
<tr>
<td>X16</td>
<td>2.70</td>
<td>1.52           3.72</td>
</tr>
<tr>
<td>X17</td>
<td>3.10</td>
<td>1.03           4.15</td>
</tr>
<tr>
<td>X19</td>
<td>3.61</td>
<td>1.70           4.37</td>
</tr>
<tr>
<td>X21</td>
<td>3.87</td>
<td>1.47           4.95</td>
</tr>
<tr>
<td>X26</td>
<td>3.06</td>
<td>1.26           3.60</td>
</tr>
<tr>
<td>X27</td>
<td>1.73</td>
<td>0.78           2.39</td>
</tr>
<tr>
<td>X29</td>
<td>3.51</td>
<td>1.57           3.96</td>
</tr>
<tr>
<td>X35</td>
<td>3.44</td>
<td>1.79           4.10</td>
</tr>
<tr>
<td>X37</td>
<td>2.96</td>
<td>0.94           5.44</td>
</tr>
<tr>
<td>X38</td>
<td>3.00</td>
<td>1.50           4.06</td>
</tr>
<tr>
<td>X40</td>
<td>4.68</td>
<td>1.50           6.18</td>
</tr>
</tbody>
</table>

**D. Validation and Consistency of the Model**

Validation is an important step because it reflects the accuracy of the prediction of the model. The consistency of Bayesian binary quantile regression on each land can be known from consistent predictions at different times. A comparison of accuracy values from the model on the low, medium and highland for 1, 2, and 3 years at some threshold points is presented in Figure 4.

The diagram on lowland show that the accuracy values above 90% and seems consistent for the last 1, 2, and 3 years predictions, while on the highland the accuracy values above 83% and seems consistent...
enough for the last 1, 2, and 3 years predictions. The accuracy of the Bayesian binary quantile regression prediction for 1 year validation with different times is in Table 3.

<table>
<thead>
<tr>
<th>Training Data</th>
<th>Testing Data</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lowlands</td>
<td>Medium Land</td>
</tr>
<tr>
<td>1981-2008</td>
<td>2009</td>
<td>91.67%</td>
</tr>
<tr>
<td>1981-2007</td>
<td>2008</td>
<td>100%</td>
</tr>
<tr>
<td>1981-2006</td>
<td>2007</td>
<td>91.67%</td>
</tr>
</tbody>
</table>

Mean: 94.45% 83.33% 86.11%

Based on the validation and consistency above, the Bayesian binary quantile regression model for all lands has good accuracy. The accuracy value of predictions in lowland is higher than in medium and highland. The standard deviation value of the accuracy of the model is quite small, that is 0.048 for lowland and highland, and 0.083 for medium land. This shows that Bayesian binary quantile regression models on all lands are consistent enough to predict extreme rainfall for the next 1 year.

IV. CONCLUSION
Bayesian binary quantile regression model is accurate to predict extreme rainfall in West Java because it has average accuracy value above 83%. The threshold values from the MOS method is good enough to determine the category of extreme rainfall. Bayesian binary quantile regression models in lowlands are better than medium and highland. Bayesian binary quantile regression models are more accurate and consistent to predict the next 1 year.

REFERENCES

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Facets of Mindfulness and Test Anxiety of Senior High Students: Basis for Strengthening Mindfulness Program

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Abstract: The study focused on the link between school-based mindfulness program activities using the facets: explaining, observing, reacting with awareness, non-judging, and non-reacting to students’ level of test anxiety. Two self-report measures were undertaken through survey questionnaire. The findings showed that through Mindfulness, the students perceived a moderate level of mindfulness in all facets and conversely low level anxiety during examinations period. The hypothesis that mindfulness and level of test anxiety are inversely related was verified in the findings. Therefore, the practice of Mindfulness in school context is perceived to lessen the test anxiety of students and it is recommended on the basis of results by strengthening the program institution through enhancing formal practice measures that will continue to address anxiety-related factors. Moreover, to provide information on its impact, researchers may uplift the study into experimental type and or a case study design.

Keywords: mindfulness, mindful breathing, correlation, psychology, program

I. Introduction

Test anxiety is an element of draining factor that needs to be dealt with especially for an individual who is under academic pressure; considered to be a widespread concern among schools bringing stressful events interfering students’ ability to perform well in exam - even for the most prepared one. This predicament seeks to entail the coping program of the school and one of which is the practice of mindfulness.

The upsurge interest of Mindfulness has reached a far distant as a program from western medicine and clinical settings, workforce, meditation and consequently its immersion to the educational sphere. The word Mindfulness is restricted to practice by enabling the state of self-awareness in a current and non-judgmental manner (Kabat-Zinn, 2003; Chiesa & Malinowski, 2011). Kabat-Zinn, J. (1994) Quoted by Srinivasan (2014), mindful breathing is a way of life, a ritual we indulge in, it’s not an abstract state; it's a kind, curious, non-judgmental consciousness we strive to add to every moment we act. Especially attentive breathing makes us more alert and less reactive.

The role of mindfulness applies widely to education (Simbulan, 2016), as Davis and Hayes (2012) described the effects of experience in lowering student anxiety and helping to enhance awareness in the current situation. Moreover, a study by Hoffman et al. (2010) and Kabat-Zinn (2003) measured the effects of mindfulness-based tension control as a mechanism to manage emotion. Results revealed an inverse correlation between awareness and anxiety, as awareness as a relaxation therapy helps mold students to stabilize anxiety, while increasing grades (Hoffman et al., 2010; Baer, et al., 2012; Brown and Ryan, 2003). Furthermore, the use of mindfulness not only helps stressed students during analysis (Kiat Hui, 2018; Srinivasan, 2014), but also demonstrates an increase in memory, less rumination, and more research focus (Davis & Hayes, 2012). In order to endorse the previous results, the researchers initialize the systematic procedure of taking care every day, referring to Srinivasan Guidebook (2014), but prior to the procedure, the researchers performed a survey at the beginning of the first week of school by conveniently sampling fifty students using Nist and
Deihl (1990) measure anxiety assessment and the results are surprisingly saddening having a high level of test anxiety result (overall mean = 3.44), which the case engendered to incorporate mindfulness hinging on the facets from Baer (2006) and to evaluate the initiative as basis for strengthening the mindfulness program.

The following queries to be investigated:
1. What is the level of overall mindfulness and test anxiety of senior high school students?
2. Are the scores from facets of mindfulness having a significant difference?
3. Is there a significant relationship between overall mindfulness scores and the level of test anxiety?

II. Framework

The research endeavored to evaluate the relationship between the overall carefulness of the five-facet senior high students (observing, explaining, behaving with understanding, non-judging and non-reacting) and the level of test anxiety of the students. Moreover, the study will be instrumental in contributing knowledge to educators and decision-makers as the basis for wider application in school context.

![Conceptual Framework](image)

**Figure 1.** Conceptual Framework

This study postulated the inverse relationship between the practice of mindfulness and level of test anxiety thus, the more conscious students likely to develop less test anxiety.

III. Methodology

The study is a descriptive correlation in nature and employed simple random sampling (n=111 from 152 with 5 percent margin of error) from Humanities and Social Sciences and General Academic strand.

The Five Facet of Awareness Questionnaire (FFMQ) is a psychometric instrument created by Baer et al., (2006) consisting of examining, explaining, behaving with awareness, non-judging and non-reacting to inner experience. The five factors serve as the main elements for assessing the awareness composed of thirty-nine (39) items with five reaction choices: 1 – never or very rarely true to 5 – very often or always true. Build validity was evident in witnessing, identifying, non-judging, and non-reacting aspects (Baer et al., 2006 as quoted by Vonderheyde, E. M., 2017). Internal consistency also showed reliability (Veehof et al., 2011; Lilja et al., 2011). Moreover, to determine the level of student test anxiety the researchers used questionnaire developed by Nist and Diehl (1990) consisting of ten items, the items have 5 Likert-like format coding: from Never (1) to Always (5). The above tools were validated and accurate by the test-retest methodology in a two-week gap on thirty students to accommodate this analysis.

The school administration obtained a letter for study purposes to conduct the study and collect the necessary data. The study was conducted in July’s first semester. Informed consent was obtained from each subject participating in the mindfulness practice and assured anonymity and confidentiality for participants. The FFMQ was conducted two days prior to the preliminary exam with the allotted time between 10-20 minutes together with the inclusion of clarity of instructions. Meanwhile, the test anxiety questionnaire was given the day after the exam. The collection of data covered one week and the responses of the participants of the study were encoded using Microsoft Excel and afterward subjected to statistical analysis using software SPSS version 23.

IV. Results and Discussion

**Level of Mindfulness**

The result shows that the overall level of mindfulness of students is moderately high (mean = 3.22), which indicates that students are conscious and aware of their feelings and able to control their actions with focus and unveils their ability to accept one’s or others emotions without judging.
Table 1. Summary of Mindfulness Facets

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Verbal Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Observing (O)</td>
<td>3.289</td>
<td>.418</td>
<td>Moderately High</td>
</tr>
<tr>
<td>2. Describing (D)</td>
<td>3.240</td>
<td>.463</td>
<td>Moderately High</td>
</tr>
<tr>
<td>3. Acting with Awareness (AA)</td>
<td>2.831</td>
<td>.638</td>
<td>Moderately High</td>
</tr>
<tr>
<td>4. Non-judging (NJ)</td>
<td>3.386</td>
<td>.792</td>
<td>Moderately High</td>
</tr>
<tr>
<td>5. Non-reacting (NR)</td>
<td>3.362</td>
<td>.744</td>
<td>Moderately High</td>
</tr>
<tr>
<td>Overall</td>
<td>3.222</td>
<td>.611</td>
<td>Moderately High</td>
</tr>
</tbody>
</table>

Legend: 4.21 - 5.00 Very High/Always true; 3.41 - 4.20 High/Often true; 2.61 - 3.40 Moderately High/Sometimes true; 1.81 - 2.60 Low/Rarely true; 1.00 - 1.80 Very low/Never true

Students’ Level of Test Anxiety
As depicted from the table below the overall level of test anxiety of students is ‘low’ (mean = 2.59), noting that this is contrast to the initial findings prior to the initialization of mindfulness which resulted a ‘high’ anxiety of students (mean = 3.44). This implies the practice of mindfulness practice helps students to minimize test anxiety.

Table 2. Descriptive Statistics of Test Anxiety

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Mean</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have obvious signs of nervousness just before my test, such as sweaty palms, shaky hands, etc.</td>
<td>2.793</td>
<td>Moderate</td>
</tr>
<tr>
<td>2. Before and during exam, I have &quot;butterflies&quot; in my stomach.</td>
<td>2.441</td>
<td>Low</td>
</tr>
<tr>
<td>3. Before an exam, I feel nauseated.</td>
<td>2.216</td>
<td>Low</td>
</tr>
<tr>
<td>4. I have read the test and feel I do not know the answers.</td>
<td>2.874</td>
<td>Moderate</td>
</tr>
<tr>
<td>5. I exhibit panic attack during examination</td>
<td>2.369</td>
<td>Low</td>
</tr>
<tr>
<td>6. During an exam, my mind is blank.</td>
<td>2.838</td>
<td>Moderate</td>
</tr>
<tr>
<td>7. I recall the details I blanked out after I got out of the exam.</td>
<td>2.523</td>
<td>Low</td>
</tr>
<tr>
<td>8. The night before an exam, I have trouble sleeping.</td>
<td>2.892</td>
<td>Moderate</td>
</tr>
<tr>
<td>9. I make mistakes with simple questions or placing responses incorrectly.</td>
<td>2.721</td>
<td>Moderate</td>
</tr>
<tr>
<td>10. I have difficulties selecting responses.</td>
<td>2.270</td>
<td>Moderate</td>
</tr>
<tr>
<td>Overall</td>
<td>2.594</td>
<td>Low</td>
</tr>
</tbody>
</table>

Legend: 4.21 - 5.00 Very High/Always; 3.41 - 4.20 High/Very often; 2.61 - 3.40 Moderate/Sometimes; 1.81 - 2.60 Low/Rarely; 1.00 - 1.80 Very low/Never.

Test of Difference on the Facets of Mindfulness
As shown in the next pages are the facets of mindfulness that are compared using one-way ANOVA. The results vividly show that there is a significant difference among the responses of the respondents from the five facets of mindfulness. In reference to the means of mindfulness in Table 1, students are more mindful in terms of non-judging and non-reacting whilst lower in Acting with awareness.

Table 3. ANOVA Facets of Mindfulness

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>22.662</td>
<td>4</td>
<td>5.666</td>
<td>14.326</td>
<td>0.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>217.504</td>
<td>550</td>
<td>0.395</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: **p ≤ .01

Correlation between Mindfulness and Test Anxiety
The table below presents the test of relationship between five facets of mindfulness and its overall score to the test anxiety of students. For which it can be gleaned that among the facets only Acting with awareness gained low correlation ($r = 0.015$), while the four facets (O, D, NJ, NR) yielded negative correlation whereas also the overall mindfulness resulted in a moderate inverse correlation and significant relationship to the test anxiety. Findings are similar to the study of Brown & Ryan (2003) and Palmer & Rodger (2009) where test anxiety can be minimized through mindfulness. Thus, it can infer that the higher incline for mindfulness the lesser disturbance of test anxiety.

**Table 4. Correlation between Mindfulness Scores and Test Anxiety**

<table>
<thead>
<tr>
<th>Mindfulness</th>
<th>r-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observing (O)</td>
<td>-0.204**</td>
<td>0.011</td>
</tr>
<tr>
<td>Describing (D)</td>
<td>-0.315**</td>
<td>0.000</td>
</tr>
<tr>
<td>Acting with awareness (AA)</td>
<td>0.015</td>
<td>0.853</td>
</tr>
<tr>
<td>Non-judging (NJ)</td>
<td>-0.316**</td>
<td>0.000</td>
</tr>
<tr>
<td>Non-reacting (NR)</td>
<td>-0.468**</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Overall Mindfulness</strong></td>
<td><strong>-0.511</strong></td>
<td><strong>0.000</strong></td>
</tr>
</tbody>
</table>

Note: **$p \leq .01$

V. Conclusions and Recommendations

The findings concluded that students have relatively high knowledge of the non-judging dimension and a significant interaction between the aspects of knowledge except behaving with awareness of the test anxiety. Hence, the more practice of mindfulness leads considerably in decreasing test anxiety for students. In light of the findings, the researchers sought that the practice of mindfulness is a timely program to be included as an anxiety relief for students. The school, through the administrators may continue to hold the practice of mindfulness especially prior to the examination of students. Also, underpinning procedures on the planning enhancement, benchmarking, formulation of guidelines, implementation and regular monitoring of mindfulness program may adhere to the school-wide level. Further, to strengthen the program the expansion of knowledge and skills may be a strong consideration like initiating attending seminars, seeking guidance for practitioners, webinars, symposia, yoga classes for teachers. More research is needed and certainly warranted to support and provide information on the impact of mindfulness as an intervention to anxiety like uplifting the study to experimental and diverse research design and large sample cases.

Acknowledgment

The researchers extend their sincerest gratitude to the administrators of the Tayabas Western Academy for their financial and moral support in the conduct of the study and to Mr. Andrian S. Nolledo for statistically treating the data.

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Rare Case Series of Synchronous Gynecologic Malignancies


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I. INTRODUCTION

FIRST TWO TYPICAL CASES OF CARCINOMA ENDOMETRIUM WITH CARCINOMA OVARY OF ENDOMETROID TYPE WITH A FUNCTIONING STROMA AND RAISED INHIBIN-B, WITH HIGH CA-125 RESPECTIVELY AND A THIRD RARE CASE OF SYNCHRONOUS OVARY WITH CERVICAL CANCER WITH ELEVATED CEA. THE ORIGIN CONFIRMED BY TISSUE IHC FOR VIMENTIN INVOLVEMENT .REPORTED AT AHPGIC

Case no1.
A 35 yrs female presented to the opd with C/O -swelling abdomen and bleeding p/vfor 15 days M/H- cycles regular. Presently menorrhagic cycles O/H- unmarried, nulligravida O/E- general pallor++,febrile,no pedal oedma,noscln, chest/cvs – ned P/A- tense ascites , palpable mass of variegated consistency of 24 wks towards right flank . P/S – fleshy polypoidal mass through os

P/V &P/R- A solid cystic mass ,lower pole felt ,mobile ,uterus small separate from the mass

Investigations –
- hb- 8 gm/dl
- Tlc-8000/dl
- TPC-1.3LAKHS/dl
- Urea-15mg/dl
- Creatinine-.83mg/dl
- Na-135mmoles/l
- k-3.7mmoles/l
- HIV,HBsag,HCV negative
- ALP- 400IU/ml,S.G.O.T/AST- 40IU/ml,
- S.G.P.T/ALT -50 IU/ml
- ALBUMIN-2.9 gm/dl
- Serum bilirubin(direct) – 2.5mg/dl
- Serum bilirubin ( total) – 2mg/dl
- CBNAAT OF ASCITIC FLUID - NEGATIVE

Serum markers-
- Serum Alpha –fetoprotein-1.61ng/ml
- SERUM BETA Hcg - .80miU/ml

Inhibin B - 1287.34 pg/ml
- CEA- .564 ng/ml
- Ca-125 – 500IU/ml

USG – Heterogenous solid lesion with internal cystic changes in pelvic cavity (b/l ovarian mass) Bulky heterogenous cervical lesion .Gross ascites and thickened endometrium. Et-30mm

MRI - The endometrium grossly thickened 30mm with polypoidal extension filling the vagina and the fornices measuring 60x36 mm with similar intensity that of endometrium,likely so endocervical polyp.
left ovary is bulky 4X6CM.Gross ascites large solid cystic mass lesion10x6.5 cm in the right adnexa s/o neoplastic etiology .

Endometrial biopsy- adenocarcinoma grade1 with squamous metaplasia and atypical hyperplasia
FIG-1 HPS OF ENDOMETRIAL BIOPSY – ADENOCARCINOMA ENDOMETRIUM
FIG-2 CHEST-XRAY PLEURAL EFFUSION
FIG-3 MRI OF ABDOMEN AND PELVIS
FIG-4 MRI OF ABDOMEN AND PELVIS

SURGERY PROCEDURE – TAH+BSO+B/L PELVIC AND PARAORTIC LYMPHADENECTOMY

IOP- 1. moderate ascites haemoragic in nature
rt adnexa solid mass of 7x10 cm, left adnexa normal
Uterus enlarged
C/S – Infiltrative growth in the cavity of uterus
omentum, and other abdominal organs healthy

large solid cystic mass lesion10x6.5 cm in the right adnexa s/o neoplastic etiology
left ovary is bulky gross ascites

The endometrium grossly thickened 30mm with polypoidal extension filling the vagina and the fornices measuring 60x36 mm with similar intensity that of endometrium, likely so endocervical polyp.
large solid cystic mass lesion10x6.5 cm in the right adnexa s/o neoplastic etiology.
FIG – 5 GROSS PICTURE OF THE SPECIMEN OF SOLID TUMOR OF RIGHT ADNEXA, LEFT TUBE AND OVARY, C/S OF UTERUS OMENTUM, B/L PELVIC AND PARAORTIC NODES

**HPS -**

**Uterus** – invasive endometroid adenocarcinoma
- Architecture- GRADE -1
- nuclear grade -1
- myometrial invasion more than 50%
- LVSI - present
The above HPS shows endometroid carcinoma of uterus with myoinvasion.

Microscopic - Rt ovary – show endometroid adenocarcinoma
- Capsule not involved
- Lvsi+ve
- Left ovary and bilateral tubes free of tumor

Fig-6A Ovarian endometroid carcinoma of right ovary
FIG 6(D)

FIG 7) Hps of ovarian endometroid carcinoma. The presence of stromal cell vacuoalation.
**Fig-8 Tissue inhibin++ in stromal cells**

Ref – takatusu yuri et al jun2013 scientific research journal

**Fig-9 Primary endometroid cancer of ovary resembling sertoliform pattern**

Cervix – chronic non specific cervicitis  
**Omentum** – shows metastatic adenocarcinom.  
**Lymph node** – right paraaortic node show features of metastasis, obturator+ve
FIG-10A (BPLND+BPAND SPECIMEN)

FIG-10 B METASTATIC AORTIC NODE

fig- 10 C Metastatic adenocarcinoma of nodes
FIG -10 D ADENOCARCINOMATOUS DEPOSITS IN LYMPH NODE
FIG -11 A DIFFUSE STRONGLY +++ VIMENTIN OF THE UTERINE CANCER

DIAGNOSIS –
A case of synchronous carcinoma ovary, with functional stromal component and synchronous endometrial carcinoma in stage III.

Discuss - The factors in favor of a primary functional ovarian component, the stromal vacuolation, raised inhibin – B, the unilateral involvement of ovary, the morphology histological picture of a primary ovarian tumor.

The functioning stromal component is suggestive of rise in inhibin-β and perhaps the cause of hyperplasia of endometrium followed by carcinoma.

FOLLOW UP – presently receiving ct rt, surviving and post surgery 6 months.

CONCLUSION –
It is primary ovarian with increase inhibin which has caused endometrial cancer grade 1. The vacuolation of the stromal cell is in favor of the functional stroma of ovarian tumor. Moreover, the nuclear grade one endometrial cancer rarely metastasises the strengthening its synchronous association. The endometroid picture of the ovarian cancer is favor of of synchronicity as is also supported by literature that these synchronous tumors are of endometroid type (95% of the cases).

Case -2
A 65 yrs female presented to the opd with c/o of Post menopausal bleeding p/v 15 days m/h - menopause attained 10 yrs back o/h - p3l3 lcm 35 yrs 0/e - p/a – a 22 weeks mass of variegated consistency p/s - bleeding + bimanual p/v p/r - a uterus bulky, a mass felt in continuity with the uterus

INVESTIGATIONS
Usg - UTERUS- anteverted and bulky and measures 8.4x4.6x4.5 cm, myometrium normal echo texture, no myometrial sol. endometrium is bulky thickness measures 13.9 mm. cervix normal OVARIES – b/l ovaries unremarkable. an ill defined hypoechoic mass noted in left adnexa with central cystic / necrotic area measuring 97x52 mm. the lesion shows central vascular with venous flow in color doppler. minimal ascites. Sol in liver.
FIG12
CA125 preop-2503.6U/ml
CA-125 -4.924 U/ML
CEA- 2.6IU/ML
INHIBIN-B – 4.67 PG/ML
D/C - ↓ SA
ENDOMETRIAL BIOPSY- ENDOMETRIAL CARCINOMA GRADE 1
PLAN – LAPAROTOMY ↓↓ GA
IOP-ASCITES+++
AFUNGATING MASS ADHERENT TO UTERUS
ADHERENT UTERUS TO MASS AND PLASTERED.
Deposits ›IVER
PROCEDURE- AHDIESIOLYSIS
TOTAL ABDOMINAL HYSTERECTOMY +BSO+MASS RESECTED IN TOTO
HISTOPATHOGY
GROSS –UTERUS ,CERVIX 7.0X5.05,0 CM
This is a case of endometrial surface irregularity and fungating mass adherent to the uterus. Sections from the fungating mass adherent to the uterine wall were taken for microscopic examination. The tumour type was endometrial adenocarcinoma of endometroid type with architectural grade g1 (well differentiated type), nuclear grade 2, myometrial invasion <50%, and no LVSI. The fungating mass adherent to the uterus, i.e., the adnexal mass, was endometroid adenocarcinoma.

**DIAGNOSIS**
Synchronous ovarian endometroid with endometrial carcinoma stage IV
The rise of CA-125 > 2000 suggestive of ovarian primary, moreover, endometrial carcinoma grade 2 with negative LVSI and <50% myo invasion unlikely metastatic to ovaries.

**TREATMENT**
ADJUVANT CTRT

**FOLLOW UP**
She is surviving post CTRT 3 yrs
Case no 3
45 yrs female presents with pain abdomen and pmb – 5 months, menopause attained, nulliparous
0/e- suprapubic mass of 20 wks size, firm of restricted mobility
p/s- growth from the endocervix
p/v- uterine height could’n t be elicited, lowerpole of mass felt, restricted mobility, pod full
INVESTIGATIONS –
CA 125-393IU/ML
CEA- 2.9IU/ML
INHIBIN-4.5 PG/ML
SMEAR-METAPLASTIC CELL WITH NUCLEAR ATYPIA
DIAGNOSTIC HYSTEROSCOPY ABD ENDOMETRIAL BIOPSY AND ENDOCEVICAL CURRETAGE DONE –
HPS- ADENOCARCINOMA, WITH SQUAMOUS METAPLASIA
DH – GROWTH FILLING THE LOWER ENDOMETRIAL AND ENDOCEVICAL CAVITY
USG- bulky uterus expanded cavity with a large necrotic mass extending down to endocervix, ET-5mm. An adnexal mass on left side.
CECT- bulky uterus expanded cavity with a large necrotic mass extending down to endocervix, left side parametrical involvement seen with a globular solid necrotic deposits left
para uterine position. Adnexal region a mass of 145x83mm. Similar deposits in para colonic gutter in right iliac fossa.
Tiny nodules in lung field. Minimal ascites
PLAN-
NEOADJUVANT CT4 CYCLES PACLTAXEL AND CARBOPLATIN AND STAGING DEBULKING
POST CHEMO CECT- CX GROWTH 30X34XMM
UTERINE GROWTH OF 7X6CM
LARGE ABDOMINOPELVIC MASS WITH ENHANCING DEPOSITS
PROCEDURE;
TYPE II RADICAL HYSTERTOMY+APPENDICECTOMY+OMECTECTOMY+RPLND
IOP-
UTERUS NORMAL SIZE ANTERIALLY A MASS OF 5X7CM
RIGHT ADNEXA BEARING TWO MASS 4.5X6.5CM
LEFT OVARY ENLARGED VARIAGATED OMENTUM AND APPENDIX NORMAL
NO FREE FLUID IN ABDOMEN
NO DEPOSITS IN LEFT OVARY AND B/L TUBES
HEALTHY
GROSS –
RIGHT ADNEXA - TWO MASS OF 4X5CM AND 6X4CM

omentum, appendix, peritoneum normal
C/S

FIG15
LEFT ADNEXA- enlarged
ENDOMETRIAL CAVITY-GROWTH IN THE LOWER UTERINE SEGMENT AND ENDOCEVIX
ENDOCERVIX – FILLED WITH GROWTH 3X2 CM
FIG16

HISTOPATHOLOGY-
CERVIX- INVASIVE ADENOCARCINOMA
GRADE -1
>50% STROMAL INVOLVEMENT
LVSI – NOT SEEN
OMENTUM-NEGATIVE

LOWER UTERINE SEGMENT INVOLVED
BOTH THE FALOPIAN TUBES AND PARAMETRIUM FREE
RIGHT OVARY- invasive adenocarcinoma of endometroid type capsule not involved.
LEFT OVARY- Extensive areas of necrosis
Uterus - no myoinvasion
Fig 19 IHC of the growth from endocervix is vimentin negative
Uterine nodule - leiomyoma
Appendix - chronic appendicitis

All lymphnodes – reactive hyperplasia
Adjuvant – received CTRT

DISCUSSION - One of the important feature which rules out metastasis is that for endometrial cancer without myoinvasion and −lvs to have a parauterine and ovarian involvement, i.e. in favour of synchronous cervical cancer with ovarian mass. The papsmear shows atypia is also suggestive of cervical cancer. The plasma CEA was raised to 2.9 iu/ml, favouring the endocervical growth. The endocervical growth stained negative for vimentin, confirming endocervical growth.

DIAGNOSIS - synchronous cervical carcinoma with uterine extension and asynchronous ovary
TREATMENT - Adjuvant CTRT
### TABLE 5 DESCRIPTION CLINICOPATHOLOGICAL FACTORS OF THE CASES

<table>
<thead>
<tr>
<th>SERIAL NOS</th>
<th>ATYPICAL HYPERPLASIA</th>
<th>ASSOCIATED SQUAMOUS METAPLASIA</th>
<th>TUBAL INVOLVEMENT</th>
<th>OMENTAL INVOLVEMENT</th>
<th>NODAL INVOLVEMENT</th>
<th>LATERALITY OF OVARIAN TUMOR</th>
<th>UNILATERAL</th>
<th>POSITIVE +VE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PRESENT</td>
<td>POSITIVE</td>
<td>-VE</td>
<td>+VE</td>
<td>POSITIVE</td>
<td>UNILATERAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NIL</td>
<td>-VE</td>
<td>-VE</td>
<td>NIL(OMETECTOMY NOT DONE)</td>
<td>-VE(NIL)</td>
<td>UNILATERAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>NIL</td>
<td>POSITIVE</td>
<td>-VE</td>
<td>NIL</td>
<td>_VE(NIL)</td>
<td>UNILATERAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 7 CLINICOPATHOLOGICAL FACTORS

<table>
<thead>
<tr>
<th>STAGE/ SERIAL NOS</th>
<th>VIMENTIN OF CV GROWTH</th>
<th>VIMENTIN OF OVARIAN TISSUE</th>
<th>CA-125 IU/ML</th>
<th>CEA/IU/ML</th>
<th>INHIBIN PC/ML</th>
<th>ENDOMETRIOSIS/FIBROID</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASE NOS 1 STAGE III</td>
<td>NIL -VE</td>
<td>++++VE</td>
<td>500</td>
<td>.564</td>
<td>1287</td>
<td>(INHIBIN-B)</td>
</tr>
<tr>
<td>CASE NOS 2 STAGE II</td>
<td>NIL</td>
<td>NIL</td>
<td>++++VE</td>
<td>2000</td>
<td>2.6</td>
<td>4.67</td>
</tr>
<tr>
<td>CASE NOS 3 (PARAMETRIUM -VE) STAGE I</td>
<td>NEGATIVE(-VE) IN IHC OF THE ENDOCERVICAL GROWTH</td>
<td>NIL</td>
<td>393</td>
<td>2.9</td>
<td>4.5</td>
<td>FIBROID+VE</td>
</tr>
</tbody>
</table>

### TABLE 8 ANALYSIS OF IMAGING (USG) CHARACTERISTICS OF THE ABOVE SYNOCHRONOUS MALIGNANCIES

<table>
<thead>
<tr>
<th>SERIAL NOS</th>
<th>Abdomino/pelvic mass</th>
<th>Uterine enlargement</th>
<th>Endometrial thickening</th>
<th>Sol in uterus/cervix(heterogeneous Ous/homogeneous S)</th>
<th>Laterality of ovarian/adnexal mass</th>
<th>ascites</th>
<th>Solid/cystic</th>
<th>Heterogenous/papillary/septal</th>
<th>RI/PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(+/+)(abdominopelvic)</td>
<td>Present</td>
<td>30mm</td>
<td>Polypoidal lesion in cervix</td>
<td>b/l enlarged ovaries right adnexa(10x6.5cm) left bulky94x5cm</td>
<td>+ve</td>
<td></td>
<td>(+/+)(right side)</td>
<td>HETEROGENOUS OUS</td>
</tr>
<tr>
<td>2</td>
<td>Present(-DO-)</td>
<td>-DO-</td>
<td>13.9MM</td>
<td>NO SOL</td>
<td>LEFT</td>
<td>ASCITES+VE</td>
<td>LEFT</td>
<td>-DO-HYPOECHOIC</td>
<td></td>
</tr>
</tbody>
</table>
II. CONCLUSION-

The study of the clinicopathological features above three cases reveal that. They present with abnormal uterine bleeding. The imaging in all the cases revealed a unilateral ovarian/adnexal mass. The masses are morphologically dissimilar. The ovarian carcinoma are of endometroid type so also the uterine cancer. The histological grade of the synchronous tumor are grade 1, in ovary, uterus and cervix. All the ovarian cancer are unilateral. Both the tubes were healthy in all the three cases. There are associated squamous hyperplasia of endometrium.

The case no three had an abnormal pap smear and final histology of adenocarcinoma with vimentin –ve rules out uterine cancer and a rise in CEA is in favour of endocervical carcinoma. The rise of inhibin-β and CA125 in case no1, is another factor, in favour of primary ovary. The inhibit was done in these case of aub with adnexal mass but was raised in one of the cases, where as CA-125 was elevated in all the cases. The vimentin was strongly positive in endometrial cancer in both the cases and negative in ovarian cancer specimen. Thus we conclude that the first two case are synchronous ovarian with uterine and the last is a synchronous cervix with ovarian cancer. The field effect (3) was evident by the presence of fibroid and endometriosis in two cases. The cases are surviving post surgery and treatment for one and half years and on follow up.

III. REVIEW LITERATURE

HPS FEATURES PRIMARY ENDOMETRIAL AND THE PRIMARY OVARY CARCINOMA

- no surface implants, ovarian parenchyma involvement
- Morphologically different
- Lack of tumor multiple lesion
- No evidence of tubal spread
- Atypical hyperplasia, sometimes squamous metaplasia
- Endometriosis in ovary favours a primary carcinoma
- Pattern of ovarian involvement

III. REVIEW LITERATURE

HPS FEATURES PRIMARY ENDOMETRIAL AND THE PRIMARY OVARY CARCINOMA

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- Morphologically different
- Lack of tumor multiple lesion
- No evidence of tubal spread
- Atypical hyperplasia, sometimes squamous metaplasia
- Endometriosis in ovary favours a primary carcinoma
- Pattern of ovarian involvement
IHC PROFILE FOR METASTATIC /DOUBLE PRIMARY
UTERINE ENDOMETROID AND OVARIAN
ENDOMETROID(1)

- Vimentin as a potential marker helpful in differentiating primary uterine endometroid and ovarian endometroid carcinoma. It is strongly positive in uterine cancer.
- The marker is negative in a primary ovarian cancer but is positive some case of endometroid cancer.
- It is expressed in 82% of primary uterine corpus and 97%-100% of ovarian endometroid associated with corpus cancer were negative for vimentin.

![IHC D/D PRIMARY/METS TATIC OVARIAN CARCINOMA FIG-9](image)

**FIG- 20 A,B IHC STRATIFICATION OF PRIMARY AND METASTATIC ROLE OF VIMENTIN.**

- Synchronous account for 7%-8% gynaecological malignancies
- Synchronous ovarian with endometroid are predominant 40-50%.
- Etiopathogenesis – “field effect”(2)

The most common features of such tumor are abnormal uterine bleeding
- Such hyper-functioning of stroma of ovarian is associated with hyperestronism
- Synchronous ovarian tumors can be endometroid mucinous, clear cell serous mixed, mucinous.(3)
- 90% of synchronous are endometroid variety.
- The presence of co-existent ovarian an endometrial carcinoma has been identified in 3-30% of endometrial malignancies and 3-10% of ovarian malignancies and 31% with coexisting endometriosis
- Etiopathogenesis- "field effect” association endometriosis, and fibroid is one of hypothesis. (3) . This suggest that the hormonal field effect may account for development of endometroid cancer, supporting the theory of estrogen receptors eifel. Etal.(4)
- Studies on another hypothesis to explain the synchronicity of gynaecological malignancies that an ‘extended’ or secondary muellerian system exist so that similarity of female upper genital tract undergoing common metaplastic diseasesa could be explained i.e the presence of squamous metaplasia in endometrium, in such cases.

**MOLECULAR MARKERS SYNCHRONOUS MALIGNANCY(4)**

- MSI,PTEN AND CTNNB1 proposed makers for synchronous malignancy
- DNA flow cytometry, loss of heterozygosity
- X-chromosome inactivation
Role of inhibin in synchronous ovarian and endometrial cancer.(5)

- Inhibin is elevated in granulosa cell tumor and mucinous tumors.
- It is normally low in endometroid cancers.
- But rise in inhibin is associated with a functioning stroma in endometroid carcinoma and well differentiated tumor in comparison to poorly differentiated.
- In premenopausal group benign ovarian lesion usually have very low inhibin.
- It has high sensitivity with ca 125 and 95% specificity as diagnostic test.

**PROGNOSIS**

- Studies showed low grade synchronous ovarian endometroid and early stage have a better survival.
- 80% - 90% with advanced have a poorer prognosis.
- Recent multicentre international study show that they have the same prognosis as primary.
- Pre-treatment ca125 and tumor stage are two independent variable.
- **INHIBIN B CONSIDERABLY INFLUENCES THE 5YR SURVIVAL**

- Inhibin is elevated in granulosa cell tumor and mucinous tumors.
- It is normally low in endometroid cancers.
- But rise in inhibin is associated with a functioning stroma in endometroid carcinoma and well differentiated tumor in comparison to poorly differentiated.
- In premenopausal group benign ovarian lesion usually have very low inhibin.
- It has high sensitivity with ca 125 and 95% specificity as diagnostic test.

Recent studies clinicopathological features of synchronous ovary and endometroid cancer suggest nulliparity and (zaino et al),(8) younger age and a median age of 50 yrs. There was no statistically significant in bmi in endometroid type. However other histological types did have a statistical significance with bmi.(sOllman et al) (7)

Eifel etal(9) reported than bleeding p/v was major complaint of endometroid type and pelvic mass was the presenting symptom of non endometoid type. The majority presented in stage 1 grade 1 and endometroid type. A study by jirapraba et al (8) showed that there was no difference in size of tumor in endometroid and other types most of them presented in grade 1 with endometroid type. The lvisi was in 14 cases of 43 cases, there was no statistical difference in endometroid and other histology types.

Overall survival of women with synchronous tumors of uterus and ovary are excellent. Zaino et al reported 5 yrs and 10 yrs survival of 86% and 80%.

In addition soliman et al(8) showed the women endometroid type had significant survival better than other type (median survival 119 mos / 48 mos p==.02).

The recent studies do show a rise in CEA in adenocarcinoma of cervix. (10)(11) CEA is found to raised more in cases of adenocarcinoma cervix than squamous cell carcinoma. A study done by kentucky et al revealed a cea more than 2.5 ng/ml.

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Abstract: COVID-19 originated in Wuhan, China spreads around the world from December 2019 kills hundreds of people in a country and thousands daily collapsing all kind of local and international human activities.

Sri Lankan societies evolve from oldest civilization, consist with multi-cultural societies and sustained with traditional socio-economic basement. “Dewey’s Theory of Social Conflict” explains that societies with primitive features are vulnerable during large scale disastrous situation to immerge conflicts and disputes. Such conflicts can be averted by using potentials of non-material cultural values blended with Social Philosophy.

Aim of this study was to identify the importance of social philosophical and non-material cultural aspects in managing disasters. Qualitative data is the main type of data. As this research conducted during the “stay at home order” reviewing literature through browsing web pages, making telephone conversation, inspection social media, observations and making inquiries were the method applied to collect data. Raw data were analyzed using related to conceptual and content analysis methods.

Results of this study reveal that consideration the main components of the non-material culture has become an urgent requirement in disaster management process. More attention should be paid on central integrals of religion, norms, values, witches, witchcrafts and magic that consisted with non-material culture. Therefore, mediation of social philosophers can be recognized as a crucial importance in finding ways and means to reduce impacts of natural and man-made disasters particularly in the countries with primitive cultural characteristics.

Key Words: COVID 19, Non-material culture, social philosophy, disaster management,

Introduction

The “Severe Acute Respiratory Syndrome Coronavirus 2” (SARS-CoV-2) or New Corona Virus Disease (COVID-19) originated in Wuhan, a city in the Hubei Province, China and spread around the world within four months from December 2019. This kind of disaster hit world widely after “Spanish Flu”, spread during 1918 -1920. Number of affected people was 500 million around the globe and one-fifth of them died . (Jarus, O, 2020).

COVID-19 kills hundreds of people in a country and thousands of people from the world within daily collapsing all kind of local and international human activities. This disease shocked the general public around the world disrespecting any divisions and matured as a disaster within short period of time. Therefore, World Health Organization (WHO) designated the COVID-19 as a “pandemic” on 11, March 2020 urging international community to take immediate action to control this endemic. By 12th April 2020, total number of infected persons around the globe is 1,776,157 and death toll is 108,804. Total number of people recovered from this disease is 402,903  (CSSE, 2020).

Total number of covid-19 infected people and deaths per day is escalating at an alarming rate in advanced countries amidst all facets of development. This situation affects negatively to developing countries like Sri Lanka having a notion of more vulnerable
to COVID-19 than developed countries. Therefore, medical practitioners other responsible and accountable officers and leaders urge government of Sri Lanka to take immediate action to control spreading this pandemic. It is a significant fact that the government of Sri Lanka respects the demand of government officers, advices of World Health Organization (WHO) and information of international mass media at this crucial juncture other than previous regimes. Closing schools and universities, imposing curfew, establishing quarantine centers, closing airport and make aware general public intensively about the horrifying nature of the COVID-19 were the main action taken by the government and relevant institutions. Other than these initiatives few “Presidential task forces” were established to cater with the epidemic and to maintain the day to day life of the general public. Police department and three forces, Director General of Health and other officers provide information and guidelines constantly. People are advised to be strict with the law and order. All these efforts seem to be help in controlling COVID 19 successfully in Sri Lanka.

Even then, getting bulk of local and international horror news coincides with immediate and sudden actions along with restrictions created array of problems throughout the country. These problems appear as social, psychological, economic, and political issues. At the same time, general public was disgusted, shocked and find faults of others. Further, they try to find solutions not only to this pandemic but also to other issues emerged around the sudden change of the socio-economic and political spheres.

The noticeable fact is the behavior of the general public has changed significantly after invading COVID-19 Sri Lanka. Going behind myths, incline to use spiritual powers, expecting healings from rituals can be seen as strategies applied by the general public to find solution for this obstacle. Surfacing old ideologies, concepts and theories are used to provide explain the causes and effects of this epidemic. Many try to find personalities who should responsible and accountable for this disaster. There are positive and negative results of this situation. One facet of this phenomenon is labeling politicians, religious doctrines, religious leaders, cultures and social groups as the accused of spreading this virus around the country. On the other hand, many people act against the law and order, ethics and cultural values. It seems that all these impacts relating to COVID-19 are the products of social philosophical and non-material cultural elements and aspects.

It is obvious that as COVID-19 hits, social philosophical and non-material cultural elements surface actively throughout every segment in Sri Lankan societies. This is because these societies evolve from oldest civilization of the world history. Further, Sri Lanka consists with multi-cultural, multi-religious and multi facets societies. At the same time, this country is still sustained with traditional and ancient socio-economic basement. Therefore, primitive features are more in the social and cultural aspects in this country than the Western world. According to the “Dewey’s Theory of Social Conflict”, this kind of social features and diversity may easily lead to create conflict and disputes among different groups of people (Frega, 2015, Robinson, N., 2016). However, such types of conflict can be averted by using potentials of non-material cultural values [5] (Nonmaterial Culture: Definition, Components & Examples, 2015).

Harvesting benefits from non-material culture of Sri Lanka has become an urgent requirement at present. Therefore, this situation should be taken into consideration as needed by the planners and policymakers. Disregarding this situation linked with social philosophical and non-material cultural aspects can easily act as a hazard which may realize as catastrophe in near future. The impact of such devastation may be greater than Tsunami-2004 or COVID-19. Effects of such disaster can be minimized through making aware the vulnerable community about disaster risk management strategies (Shawiah, F.F.S.B., 2016, Inonye, J. 2014, Outreville, J. 1998 and Arnold et all, 2018). This includes understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment. Such knowledge can be used for risk
assessment, prevention, mitigation, preparedness and response [9] (UNDRR, 2015). Ministry of Disaster Management of Sri Lanka initiated numerous programs to manage impacts of disasters for over 16 years. Yet, the involvement of general public in managing the impacts of COVID-19 epidemic is not in satisfactory level. One of main reason for this might be the disregarding the potentials of metaphysical values inherited with Sri Lanka.

Sri Lanka Disaster Management Act, No 13 of 2005 had paved the way to established three intuitions namely Ministry of Disaster Management, National Council for Disaster Management and Disaster Management Centre. The overall objective of this act is protect human life and property of the people and the environment of Sri Lanka from the consequence of these disasters, by effectively dealing with them from a national perspective by the preparation of a national policy and a plan and by the appointment of centrally co-ordinated committees and institutions to give effect to such policy and plans. These establishments can be directed to explore the ways and means to streamline the values of metaphysical and non-material cultural aspects of Sri Lankan social groups into manage disasters such as COVID-19 successfully.

Social Philosophy and Non-Material Culture and Their Aspects

“Social philosophy” is one of the main branches of the subject of philosophy. “Non- material culture” is a core and first order concept of the social sciences such as sociology and anthropology.

There are numerous introductions and definitions in the literature given to explain the scope and functions of social philosophy. When analyzing them, it can simply be concluded that social philosophy deals with concepts discussed and developed in the subject field of social sciences. Social sciences some time named as art subjects are divided into main two subject areas in Sri Lanka as social science and humanities. Main subjects that engage with core social functions and issues in these fields are geography, sociology, history, archeology, economics, and political science. Subject streams dealing with religions, fine arts, languages, mass communication, disaster management etc. are also recently developed subjects within the field of social sciences.

According to prominent philosopher Harry Allen Overstreet (1914), main objective of the social philosophy is inspection of concepts more penetratingly given by social scientists. As the subject areas of all subjects in social sciences are organized and controlled by the curricular, academics and respective scholars do not have a room to pay attention on all facets of respective concepts. Therefore, metaphysical aspects, moral and ethical questions have to be kept aside. For example, concepts on soil, rocks and water are discussed in the subject of geography. Yet social value of them and ethical responsibility of conserving them are vaguely or not taking into consideration by the geographers. Therefore, acquiring extensive knowledge and averting moral questions on soil, rocks and mineral by the respective scholars do not help to conserve and to practice to sustainable use of these resources. In such situations, social philosophers can mediate to develop new concepts or strategies to solve mistreated issues and adduced reasons by the social scientists (Robinson, N, 2016).

In order to ensure the utilization of social power positively and averting social conflict social philosophers such as Frega, (2015) Overstreet (1914), and Robinson (2016) urges to make philosophical inquiry over the concepts dealt with the social sciences. This initiative paves the way to make metaphysical and logical inquiries interpretation comprehensively and critically on social issues. Such drive services to understand the real and authentic moves relevant to contemporary social powers. Knowledge on the behavior of social power would help to recognize suitable and appropriate “social control measures” that can be utilized in a disastrous situation like COVID-19, to reduce the impacts of such epidemic. Therefore, it can be accepted that the concept of “Non- material culture” comes directly under the purview of social philosophy.
The concept “Non- material culture” is defined as the rules and standards of society that circumscribe individual action through the inculcation of conventional sanctions and the imposition of formalized mechanisms (“Social control”, 2020). There are seven components of nonmaterial culture (Study.com, 2020). They are gestures, language, values, norms, sanctions, folkways, and mores. These components are interconnected and shape by religion, belief system, myths and other metaphysical aspects of the social groups, social power or culture. Researchers have found out that culture influences directly to disaster risk reduction initiatives (Kulathunga, U. 2010, Kyoo-Man Ha, 2015). This shows that many have found the influence of non- material cultural aspect in to the disaster management process similar to the legal system in a country.

**Aims of the Research**

Main aim of this study is to identify the importance of social philosophical and non- material cultural aspects in managing the disasters such as OCVID 19. Secondary objectives of the current study are to trace laps and gaps of the behavior of among individuals and social groups in Sri Lanka. Fulfilling these objectives would pave the path for a revision of the concepts of disaster management.

**Methods and materials**

Qualitative data are main type of data used in this study. Reviewing literature through library survey and web pages browsing were the main method that used to collect data. Both published peer reviewed journal articles, online encyclopedias, distortionary were the main sources of information of the study. As this article compiled during the COVID 19 induced “stay at home” order, Telephone conversation were made with due academics to get clarification and further information over the concerned matters. Official information on the impacts and the disaster management process in Sri Lanka and other countries were collected through reputed television channels. Social media such as Face Book (FB) and information from general public contacted were used to collect relevant information. Observations and inquiries made to verify he collected data. Collected data were analyzed using methods related to conceptual analysis and content analysis.

Though this study based on contemporary actual ground trough phenomenon, references for them did not included into this paper in order to reduce the length of the list of reference.

**Result and discussions**

Behavior of the general public during the COVID 19 controlling period which are closely related with “non- material culture” in Sri Lanka can be divided into two as positive and negative. Factors that influenced for such behavior can be analyzed with the help of concepts and theories relevant to Social Philosophy. It is obvious that metaphysical elements of individuals and social groups are surfacing remarkably as social behavior explained by the concepts relevant to “social philosophy” and “non-material culture” in Sri Lanka parallel to the consequences of the contemporary COVID-19 pandemic. These significant acts of people were taken into consideration in this study.

Since the behavior of people is a mixed influence of the socio-cultural and political background, it is difficult to categorized social behavior according to the components of non-material culture. Therefore, findings of this study were divided into six groups as:

1. Religious Behavior and folkways of general public
2. Moral, ethical behavior and social values of general public
3. Reemerging traditional gestures and taboo of general public
4. Myths banquet among general public
5. Immoral behavior committed against the advises of government
6. Immoral and unethical behavior of people committed during the period of curfew (stay at home order)

All these behavior of few individuals or members of social groups has influenced by the actions taken by the government as measures to control the spread of COVID-19 in Sri Lanka. Among these six categories first three can be regarded as positive social appetites. Examples of these three are as in table 1, 2 and 3 given below. Tables 4, 5 and 6 provide the negative traits of people that could be identified during the COVID-19 nitrous situation in this country. All these positive and negative characteristics of the behavior of general public are not previously crafted by any organized program or a social power. All these are just culminate and emerge from natural evolvement of the socio-economic and political background.

Buddhist monks had organized “pirith” chanting ceremonies in all temples all over the country. Some individuals, institutes and group of people distributed food rational for free of charge. Islam devotees requested from the government not to cremate and bury the remains of the Islam devotees who died from COVID-19 infections. There are arguments for and against over the government commitment of controlling this pandemic. Ayurvedic doctors prescribed indigenous medicine to prevent from COVID-19. Whether, these practices are good or bad, right or wrong general public in Sri Lanka are involving actively over these opinions and activities. This shows that there huge potential and enthusiasm among social groups discussed in the Social Philosophical theories and non-material cultural concepts. This kind of metaphysical values can be incorporated to harvest benefits from the established disaster management initiatives of Sri Lanka.

Conclusion

Results of this study shows that, there are enormous strengths, possibilities and potentials imbedded into the culture of Sri Lankan society which can be used to reduce impacts of disasters. The important fact is to harvest these benefits from existing non-material cultural aspects can be employed as a drive without investing huge bulk of money or other resources. On the other hand, if the respective parties ignore the negative traits of the general public that surfaced during disastrous situation, repercussion would be beyond the coping capacity of Sri Lanka. Therefore, it has become an urgent and important requirement for taking into consideration the main components of the non-material culture in the whole process of disaster management process. At this point, attention should be paid on central integrals of religion, norms, values, witches, witchcrafts and magic (white and black) that consisted with non-material culture.

Inspecting and inquiring non-material cultures which craft the social powers, social controls and belief systems concentrated around magic through the light of Social Philosophical point of view critically would help to manage disasters satisfactorily. This will reciprocally create smooth path to gain economic development as well as social development of the country.

Social development helps to maintain the “social powers”. Negative appetites of social groups cannot be controlled only by just available and out dated laws and “social control measures” in a multi-cultural and multi-faceted country like Sri Lanka. Many components relating to social control measures are very old or not revised according to contemporary socio-economic changes. Therefore, social philosophers should mediate at this juncture to find ways and means to solve coming social issues relating to both natural and man-made disasters.

Acknowledgment

Several scholars help me to carry out this study. Suggestions and clarifications made over the concepts and central theme of this article through telephone conversation and passing emails. I grateful to thank Senior Prof. Gamini Hapuarachchi, Senior Prof. Department of Philosophy and Dr. Ubesekeara Dissanayake, Senior Lecturer, Head, Department of Sociology of the University of Kelaniya, Sri Lanka for their valuable encouraging support to given.

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## Table 01

### Religious Behavior and Folkways of General Public of Sri Lanka During the COVID-19 Disastrous Situation

| Main and Minor Activities Performed by General Public to Showcase the Acts of Generosity and Spiritual Power |
|---|---|
| **1** Conducting religious activities in order to get spiritual power | Chanting “Pirith”*  
- Preaching religious talks (Bana Deshana)  
- Arms giving ceremonies  
- Chanting in Christian churches and  
- Chanting in Hindu Covils (Temples)  
- Chanting in Muslim (Islam) churches |
| **2** Committing rituals for healing and appealing from God | Spending devotional life  
- Worshipping Gods  
- Devote valuable belongings to God  
- Worshipping and venerating “Bo tree”  
- Reserving valuables for Gods to end this epidemic as soon as possible  
- Lighting oil laps - “pahan”  
- Offering gifts for Gods  
- Promising to offer sacrifice in front of the sacred places, such as shrine rooms of Lord Buddha and different kinds of Gods, Buddhist dagabase and devalayas  
- Promising to offer sacrifice in front of the sacred things places such as sacred trees, statues of Lord Buddha and Gods.  
- Worshipping artifact made in ancient or modern times |

## Table 02

### Moral, Ethical Behavior Social Values of General Public of Sri Lanka During the COVID-19 Disastrous Situation

| Main and Minor Humanistic Activities Performed by General Public to Showcase the Acts of Generosity and Spiritual Power |
|---|---|
| **1** Offering dry rations for free of charge to vulnerable families and persons |  |
| **2** Contribution personal money for funds established by the government for COVID 19 pandemic controlling program |  |
| **3** Educating general public over the safety measures |  |
| **4** Participating requested program voluntarily by the government |  |
| **5** Providing needed information to government enthusiastically |  |
| **6** Initiating and carrying out essential and urgent activities voluntarily |  |
| **7** Taking life threatening risks when needed |  |
| **8** Finding and inquiring about difficulties faced by even unknown people |  |
| **9** Compelling to produce urgent and vital clinical equipment and machines and offer them freely. |  |
| **10** Adhering to health and other official advices willingly and devotedly |  |

## Table 03

### Reemerging Traditional Gestures and taboo of General Public of Sri Lanka During the COVID-19 Disastrous Situation

| Greetings* | Sinhalese say the word “Ayubowan” after palms clasping together as if in prayer at chin level with a slight nod of the head. “Ayubowan” means you be blessed with a long life.  
Tamil say the word “vanakam.” means you be blessed with a long life. (This is recognized as a most important way of greeting to prevent from infecting COVID-19) |
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td></td>
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</table>
Quarantine |
Quarantine or stay at home is a “taboo” in traditional method practice by Sri Lankans to prevent from spreading diseases. Hanging “Kohomba leaves” (Azadirachta indica - English: Neem tree) in front of home is a signal that the particular home is reserved as quarantine center.

<table>
<thead>
<tr>
<th>(Table 04)</th>
<th>Myths Banquet Among General Public Over COVID 19 Pandemic In Sri Lanka</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Category</td>
<td>Fine points</td>
</tr>
<tr>
<td>1</td>
<td>Nature of coronavirus</td>
</tr>
<tr>
<td></td>
<td>Most dangerous virus ever develop in the world</td>
</tr>
<tr>
<td></td>
<td>Affect only to physically weak people</td>
</tr>
<tr>
<td>2</td>
<td>Reasons for origin</td>
</tr>
<tr>
<td></td>
<td>God that controlled the earth is displeased with the people who do bad, brutal and unethical and act to punish them</td>
</tr>
<tr>
<td></td>
<td>Reacting environment against the human activities that led to create environmental problem</td>
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<tr>
<td>3</td>
<td>Origin from</td>
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<tr>
<td></td>
<td>From eating cats and dogs</td>
</tr>
<tr>
<td></td>
<td>From having soup of bats</td>
</tr>
<tr>
<td></td>
<td>From polluted environment</td>
</tr>
<tr>
<td></td>
<td>Deliberately created and released</td>
</tr>
<tr>
<td></td>
<td>Side effect of testing a weapon</td>
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<tr>
<td></td>
<td>Recurrence/reappearance of a virus that has a 100 year cycle</td>
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<tr>
<td>4</td>
<td>Infect only for</td>
</tr>
<tr>
<td></td>
<td>Elders</td>
</tr>
<tr>
<td></td>
<td>Weak persons</td>
</tr>
<tr>
<td></td>
<td>Cursed people</td>
</tr>
<tr>
<td>5</td>
<td>Protecting from infection</td>
</tr>
<tr>
<td></td>
<td>Wearing mask would protect from infecting the virus</td>
</tr>
<tr>
<td></td>
<td>Closed down infected areas completely</td>
</tr>
<tr>
<td></td>
<td>Washing hand with soap is adequate</td>
</tr>
<tr>
<td></td>
<td>Using and spray is enough</td>
</tr>
<tr>
<td></td>
<td>Living in hot area with climate – tropical region</td>
</tr>
<tr>
<td>6</td>
<td>Things to take as medicine</td>
</tr>
<tr>
<td></td>
<td>Eating garlic and drinking water</td>
</tr>
<tr>
<td></td>
<td>Antibiotics help to prevent the virus</td>
</tr>
<tr>
<td></td>
<td>Drinking hot water six times per day flush the virus</td>
</tr>
<tr>
<td></td>
<td>Rinse mouth with salt water will remove the virus</td>
</tr>
<tr>
<td></td>
<td>Gargling bleach</td>
</tr>
<tr>
<td></td>
<td>Inhaling evaporates of warm water thrice a day</td>
</tr>
<tr>
<td></td>
<td>Having extra amount of alcohol/liquor</td>
</tr>
</tbody>
</table>

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<tr>
<th>(Table 05)</th>
<th>Immoral Behavior committed Against the Advises of Government Given to Protect from COVID-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main and minor misbehavior of general public that showcase the acts of not adhering to advice given by the government to.</td>
<td></td>
</tr>
<tr>
<td>Not refrain from</td>
<td></td>
</tr>
<tr>
<td>Refrain from quarantine purposely</td>
<td></td>
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<tr>
<td>Averting wearing masks</td>
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<tr>
<td>Wearing masks improperly</td>
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<tr>
<td></td>
<td>Infecting the Virus</td>
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<tr>
<td>2</td>
<td>Not refrain from spreading the pandemic</td>
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<tr>
<td>3</td>
<td>Violating rules and regulations or law and order imposed (as curfew) to control COVID 19</td>
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</table>

**Table 06**

<table>
<thead>
<tr>
<th></th>
<th>Immoral and unethical Behavior of few people Committed during the curfew imposed (stay at home order) to Protect from COVID-19</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stealing Shoplifting Burglary Smuggling</td>
</tr>
<tr>
<td></td>
<td>Stealing taking grants from curfew</td>
</tr>
<tr>
<td></td>
<td>Break in shops and stealing - specially liquor and medicine</td>
</tr>
<tr>
<td></td>
<td>Looting money from government officers who were in the field</td>
</tr>
<tr>
<td>2</td>
<td>Committing illegal and unethical activities</td>
</tr>
<tr>
<td></td>
<td>Mining treasure, gem, sand..</td>
</tr>
<tr>
<td></td>
<td>Participating for illegal games- card playing</td>
</tr>
<tr>
<td></td>
<td>Producing alcohol using primitive methods</td>
</tr>
<tr>
<td></td>
<td>Shooting down wild animal to get flesh</td>
</tr>
<tr>
<td></td>
<td>Killing domestic animals for food</td>
</tr>
<tr>
<td></td>
<td>Use of social media (FB) to arouse general public</td>
</tr>
<tr>
<td></td>
<td>Throwing kerosene oil into the heap of vegetable</td>
</tr>
<tr>
<td>3</td>
<td>Domestic violence</td>
</tr>
<tr>
<td></td>
<td>Quarreling among family members as a side effect of stress developed as results of being at home long period of time</td>
</tr>
</tbody>
</table>

**List of Reference**


Sustainable principles of indigenous *chena* cultivation and management in Sri Lanka: lessons for contemporary agricultural problems

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**Abstract:** The central aim of this study was to identify lessons that can be learned from the indigenous *Chena* cultivation techniques to address the contemporary agricultural problems. Data for the study were drawn from a field survey conducted in a historically significant area for *Chena* cultivation—the Kapugolla agrarian division in the Rajarata region of the country—during the period from May to August, 2014. By employing qualitative research approach, 40 experienced adult farmers, mostly over 70 years of age were interviewed. The findings revealed that sustainable principles and management practices of indigenous *Chena* cultivation in Sri Lanka provide solutions for contemporary agricultural problems such as issues related to agrochemical usage, high cost of production, insufficient income, issues related to cropland productivity, food safety and farmer safety, water shortage problem in farming, etc. Thus, study indicates the importance of taking into account sustainable characteristics of indigenous *Chena* cultivation technology to address contemporary agricultural problems.

**Keywords:** Indigenous *Chena* cultivation, Modern agricultural problems, Sri Lanka, Sustainable principles, Management practices

1. **Introduction**

Agricultural historians in Sri Lanka have focused little on the micro-level indigenous agricultural techniques and management practices that have been practiced and developed by indigenous farmers’ overtime. It has been found that the indigenous agricultural structure in the dry zone of Sri Lanka is mainly based on a three-fold system, involving rice cultivation, shifting cultivation and home gardens. Shifting cultivation-mostly referred to as *Chena* cultivation—has been recognized as an important part of the rice-rice based subsistence agricultural economy of the country since ancient time. It is an agricultural system in which a selected plot of land is cultivated temporarily and then abandoned and allowed to return to its natural vegetation, while cultivation is shifted to another plot. This type of cultivation involves unique technology and management practices, which were developed based on the extensive experience of indigenous farmers over centuries.

The historical account of *Chena* cultivation system in Sri Lanka reveals a gradual decline of interest in *Chena* cultivation with the technological changes in agriculture and demographic changes in the country. First, the colonial empires neglected these systems because they were not suiting the needs of capitalist development as did plantation agriculture (cinnamon, tea, rubber and coconut) due to their subsistence nature. Therefore, the rules and regulations enacted by the colonial empires in the country set up barriers to *Chena* cultivation (Silva, 1981). For instance, underdeveloped land was defined by land ordinance No. 1840 (Crown Land Encroachment Ordinance) as all forest, waste, unoccupied or uncultivated lands, which shall be presumed to be the property of the crown until the contrary is proved. Under this land ordinance, the farmers in the dry zone first lost their land used for *Chena* cultivation because those lands were referred to as waste land. Most scholars criticize this land policy, as it did not correctly acknowledge the domestic traditions, customs and values attached to agriculture or the nature of domestic agriculture (Roberts, 1973). Second, the rapid increase of the population of the country limited the land suitable for *Chena* cultivation, and thus, farmers had to move to more marginalized agricultural land in the dry zone for *Chena* cultivation. Third, similar to other Third World countries, the application of universal social theory (technological changes in agriculture) to agriculture in Sri Lanka in the post-colonial period was the most influential cause of the major change in the techniques and management practices of *Chena* cultivation in the country. Similar to the rice sector, these technological changes were expected to enhance crop productivity in uplands and thereby ensure food security by taking into account economic models of agricultural production and technological change. These practices resulted in the difference between the techniques adopted in the past and present in *Chena* cultivation. The consequences of these technological changes have mainly been cited in the academic literature in terms of factors such as natural resource management, farm household food security, food safety, the regional environment and local resource utilization. For instance, the World Health Organization (WHO, 2012) reported a high rate of chronic kidney disease (CKD) among...
farmers who practice the modern *Chena* cultivation techniques. Some researchers have recognized the techniques adopted in *Chena* cultivation as rudimentary, which has led to misjudgement regarding the important values and principles of indigenous techniques of *Chena* cultivation from the view point of current problems accompanying modern techniques or Western scientific knowledge.

However, most researchers are interested in emphasizing the current limitations of *Chena* cultivation in terms of global climate change, population growth, resource use and management practices and biomass burning (Hettiarachchi, 1984; Sandika & Withana, 2010). It has been found that indigenous techniques used in agriculture are not practical for mass food production but can contribute a substantial amount to local food production in developing countries (Jeeva, et al., 2006). Though there are specific limitations of *Chena* cultivation, only a few researchers are doing relevant field work to identify the sustainable principles of indigenous *Chena* cultivation technology to understand to what extent these techniques provide solutions for the contemporary agricultural problems accompanying technological change in Sri Lanka. The identification and utilization of such sustainable principles of indigenous techniques in agriculture will help to fill the gap between indigenous and modern techniques in agriculture, which remains an important issue that should be focused upon. To fill this research gap in the field, the objective of this study is therefore to investigate the sustainable principles of the indigenous *Chena* cultivation system, with the aim of obtaining lessons related to contemporary agricultural problems in Sri Lanka and other tropical countries.

2. Materials and Methods

Historical-Comparative (H-C) methodology was employed in this study. Data for the study were drawn from a field survey conducted in a historically significant area for *Chena* cultivation—the *Kapugollawa* agrarian division in the *Rajarata* region of the country—during the period from May to August, 2018. This agrarian division was selected because the indigenous agrarian structure, particularly the indigenous *Chena* cultivation system, remains in the area. The reason for this situation is that the area is located far from the urban cities in the province and at the boundary of a conflict-affected area that has become peaceful since 2009. Thus, the influence of modern techniques in agriculture has not reached this area. According to the agrarian service center in the region, 600 ha were under *Chena* cultivation and 3,945 ha under paddy cultivation at the time of the survey.

Due to the nature of the phenomenon being investigated, the study mainly relied on qualitative data collected from farmers by applying the oral history method, which is a type of recollection method employed in historiography. For data collection, experienced adult farmers, mostly over 70 years of age, were selected for the survey, as these individuals represent the only remaining generation who still apply the techniques and management practices of indigenous *Chena* cultivation. In-depth interviews were conducted among 40 farmers selected by applying the purposive sampling technique. The survey gathered data on the details on farmers’ past and present knowledge of the techniques and management practices applied in *Chena* cultivation in the region to reveal the importance of these techniques and to find solutions to contemporary problems in agriculture. Moreover, key informant interviews were conducted among the leaders and former leaders of traditional agricultural organizations and officers of the agrarian service centers in the survey area.

3. Results and discussion

3.1 Historical account of *Chena* cultivation in Sri Lanka

*Chena* cultivation has been practiced in Sri Lanka for thousands of years, similar to the countries of South Asia. There is much historical and archaeological evidence revealing the history of *Chena* cultivation. Archaeological excavations in the *Doravaka-kanda* cave have provided evidence of the use of pottery and the cultivation of cereals as early as 6300 BC (Deraniyagala, 1992). The *Mahawansa* historical chronicle states that the *Yakka* Queen *Kwweni* weaved cotton (*Kapu*), indicating the existence of *Kapu Chena* in two thousand years ago. According to the historical literature, there were three types of cottage industries: weaving, producing jaggery, and extracting edible oil. This indicates the existence of formalized cotton (*kapu*), sugarcane (*uk*) and sesame (*talu*) cultivation in *Chena* lands. In particular, sesame, kodo millet (*Amu*) and meneri were grown by the people of the Anuradhapura period.

Moreover, the *Mahawansa*, *Thupawansa*, *Saddamarathnawaliya* and *Pujawaliya* reveal that in the 13th century, crops such as kodo millet, meneri, finger millet, foxtail millet (*thanahal*), black lentil (*udu*) and green gram (*mun*) were grown by the local people. The *Saddamarathnawaliya* further revealed that there were two cultivation seasons, *Yala* and *Maha*, and people reserved seeds for each season (Govi Janatha, 2005). Moreover, literature written in the Kurunegala, Gampola, Kotte and Seethawaka periods provides adequate evidence that *Chena* cultivation played a
major role in the livelihood of local people. The inscriptions written by king Nissanka Malla (1187-1196) also referred to *Chena* cultivation. Specifically, Siriweera (2005) reported that there were many types of cereals grown in indigenous *Chena* cultivation, such as finger millet (*kurrakan*), *undu* (*phaseolus mungo*), *ma* (*vigna clyndrica*), *mun* (*phaseolus aureus*), *meneri* (*Paspalum scrobiculatum*), *aba* (*Brassica juncea*), *dura* (*Cuminum cyminum*) and *tana* (*Setaria italic*), in addition to vegetables such as *vambatu* (*Solenum melongena*), *vattaka* (*squash Curcubita mixima*) and *alu puhul* (*waxgourd Benincasa hispida*) and other *Solenum* species. The special interest of people in *Chena* cultivation in the indigenous period is further demonstrated by the names of ancient villages such as *Henegama*, *Weherahena*, *Viharahena*, *Ginigathhena*, *Hene pela*, *Hendeniya*, *Kotahena*, *Nugahena* and *Mahena*.

3.2 Sustainable characteristics of indigenous techniques and management practices applied in *Chena* cultivation

3.2.1 Timely cultivation

In indigenous agriculture, timely cultivation indicates a specific set of cultivation practices adopted by farmers in each season, in line with the direction of the movement of sunrays towards the country—either from the Equator or from the Tropic of Cancer or Capricorn. According to the indigenous knowledge of the local farmers, the sunrays that fall on the Earth vary in each month, and these variations affect the life cycle of plants. Based on the changes in the sunrays reaching Sri Lanka, the indigenous farmers determined two cultivation seasons for the country: *Yala* and *Maha*, and they manage their cultivation practices accordingly. Table 1 provides the activities and stages of crop plant growth reported by the farmers in each month of the year for rice *Chena*. The scientific rationale for this technique was explained by the key informant interviews, as depicted in Figure 1. Based on this technique, the farmers traditionally cultivate short-term rice varieties, such as *Hetada vee*, for the *Yala* season and long-term rice varieties for the *Maha* season. This is mainly due to the short period of the shift in the direction of sunrays from the Equator to the Tropic of Cancer and from the Tropic of Cancer to the Equator and the long period from the Equator to the Tropic of Capricorn and from the Tropic of Capricorn to the Equator (Figure 1). In terms of other crops, the farmers take apply same technique, considering the life time of the crop species. In particular, there are specific months for harvesting each crop. For instance, in the *Maha* season, the farmers first cultivate four-month finger millet varieties in October. Harvesting generally begins in November, depending on the crops being grown, and may continue until January.

According to indigenous farmers’ experience, the technique of timely cultivation first contributes to enhancing yields. The scientific rationale for this view is that in rice *Chena*, the panicle initiation time falls within the period of the lowest temperature difference between day and night, as the sunrays are directed toward the country from the Tropic of Cancer or Capricorn in the *Yala* and *Maha* seasons, respectively. Based on this technique, the farmers expect a high yield due to creating a favorable environment for pollination, particularly in terms of the temperature. Second, it reduces pest attacks and diseases, as the plant growing period falls within the period in which the temperature is relatively high, and the panicle initiation time falls within the relatively dry period. Third, it helps to manage the water supply throughout the plant growth period and harvesting time. As shown in Table 1, *Chena* practices are associated with the direction of the movement of sunrays and the rain calendar in the region, which will be discussed at length in the subsequent sections of the paper.

**Table 1** *Chena* cultivation activities under timely cultivation techniques applied in rice *Chena* in the *Rajarata* region

<table>
<thead>
<tr>
<th>Season</th>
<th>Month</th>
<th>Rice <em>Chena</em> practices and steps of plant growing period</th>
<th>Weather conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Yala</em> season</td>
<td>April</td>
<td>Planting or sowing</td>
<td>Rainy period</td>
</tr>
<tr>
<td></td>
<td>May</td>
<td>Plant growing period</td>
<td>Rainy period</td>
</tr>
<tr>
<td></td>
<td>June</td>
<td>Panicle initiation time</td>
<td>Minimum temperature difference at day and night</td>
</tr>
<tr>
<td></td>
<td>July</td>
<td>Maturing period</td>
<td>Dry period</td>
</tr>
<tr>
<td></td>
<td>August</td>
<td>Harvesting</td>
<td>Dry period</td>
</tr>
<tr>
<td></td>
<td>September</td>
<td>Land preparation</td>
<td>Dry period</td>
</tr>
<tr>
<td><em>Maha</em> season</td>
<td>October</td>
<td>Planting or sowing</td>
<td>Rainy period</td>
</tr>
<tr>
<td></td>
<td>November</td>
<td>Plant growing period</td>
<td>Rainy period</td>
</tr>
<tr>
<td></td>
<td>December</td>
<td>Panicle initiation time</td>
<td>Minimum temperature difference at day and night</td>
</tr>
</tbody>
</table>
3.2.2 Rain calendar cultivation technique

In the Maha season, Chena farmers generally begin their land preparation activities when a light rain known as Nikini paluwa falls, which usually occurs from the end of July to early August, after the long drought known as the Nikini drought (Nikini idoraya, usually beginning in early July). First, the farmers cut the field to burn the existing biomass to recycle its nutrients. The sowing of finger millet takes place when the Ak rain falls, which usually occurs from end of September to early October. The aim of sowing finger millet with the Ak rain is to allow a harvest to take place in the face of the impending food shortage in farm households in December. Most of the Chena farmers in the region adopt the poly-culture cropping technique in association with the north-east monsoon rain (Maha wesi) (see Figure 2). One of the environmental indicators used to determine the end of the period for planting seeds is the blooming of Niyagala (Gloriosa superb) flowers in the region. The farmers assume that this indicator shows a relationship with rainfall patterns in the region and the direction of movement.

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Table 2 Relationship of Chena Cultivation Techniques with Rainfall Patterns in the Rajarata Region

<table>
<thead>
<tr>
<th>Rainfall pattern</th>
<th>Period</th>
<th>Chena cultivation activities and steges of plant growing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yala season</td>
<td>March</td>
<td>Commencement of land preparation for the Yala season</td>
</tr>
<tr>
<td></td>
<td>(Slight rain) Bakmaha wesi</td>
<td></td>
</tr>
<tr>
<td>Maha</td>
<td>Nikini drought (Nikini)</td>
<td>July to the end of</td>
</tr>
</tbody>
</table>

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www.ijsrp.org

Figure 1 Scientific view of the timely cultivation technique

Source: Key informant interview with Mr. Thilak Kandegama, 2018
3.2.3 Lunar calendar farming technique in Chena cultivation

The indigenous Chena farmers strongly believe that the Moon affects the plant life cycle and therefore depend on the lunar calendar farming technique. In particular, decisions regarding periods for the sowing and harvesting of crops are made based on the lunar calendar. Table 7-3 shows how farmers determine the sowing and harvesting periods for different crops (seed and fruit crops, root crops and leafy vegetables). To explain the rationale for this technique, the farmers usually take into account several environmental indicators, such as the wadadiya-badiya scenario, the honey harvesting period and the assumed childbirth period. These indicators are tied to the idea that during the period of Moon movement from the new moon to the full moon, the water content in the human body as well as in crops gradually increases, and vice versa from the full moon to the new moon. This nature-bound law has been utilized by the farmers to classify indigenous crops grown under Chena cultivation to face challenges such as those related to water availability, pests and disease and to increase the harvest. For instance, the farmers consider the period of Moon movement from the new moon to the full moon as a suitable period for the sowing and harvesting of seed and fruit crops, as Moon affects the level of production. On the contrary, the farmers believe that the water content in the soil gradually improves in the period from the full moon to the new moon, and they therefore select this period for the growth of root crops, such as sweet potato, cassava and onion. However, they reported the period from the new moon to the first quarter and from the full moon to last quarter as particularly suitable periods for root crops. Based on the same principle, leafy vegetables grow from the new moon to the full moon period. This indicator basically affects the plant growth cycle and maturity at harvest, thereby increasing the harvest.

Table 3: Suggested periods for the sowing and harvesting of crops

<table>
<thead>
<tr>
<th>Lunar cycle</th>
<th>Seeds &amp; fruits (Cereals, pulses, oil seeds &amp; fruits)</th>
<th>Roots</th>
<th>Leafy vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>New moon to 1st quarter</td>
<td>Rice, Finger millet, Sesame, Green gram, Cowpea, Black gram, Maize, Black lentil, Kodo millet, Mustard, Cumin, Foxtail mille, Horse gram, papaya, Banana, water melon</td>
<td>E.g., Sweet potato, Cassava, Onion</td>
<td>Pumpkin, Cucumber, Tibbatu (Solanum indica, s.), Egg Plant, Spine gourd, Bitter gourd, Ribbed gourd, Chili, Okra, Tomato, Long bean, Kakiri.</td>
</tr>
<tr>
<td>1st quarter to full moon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full moon to last quarter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last quarter to new moon</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field survey, 2018
3.2.4 Poly-culture cultivation technique and crop diversification practices in Chena

One of the main sustainable principles of the indigenous Chena cultivation technology is the use of diversified and poly-culture cropping techniques. These techniques are based on agro-ecological diversity and internal inputs at the regional and farm levels. This cropping structure is completely independent of chemical inputs and is integrated with locally and historically developed indigenous knowledge. Under the poly-culture technique employed in Chena cultivation, the farmers mix the selected types of seeds varieties together, and these mixed seeds varieties are planted under Chena cultivation. The farmers practice this technique to ensure the household food supply as well as nutritional balance and food security throughout the year and to minimize pests and control diseases in crop fields. According to the key informant interviews, the selected crop varieties for Chena have the special characteristic of attracting unfavorable pests to the Chena field at the first stage, which in turn attract favorable pests to the field. Thus, a natural environment is provided for controlling the pests on the crop without the use of any chemicals. In this context, the farmers specifically select nine types of crops for Chena, and it is therefore known as Nawadalu Chena. It was reported that the selected crop varieties also have specific characteristics related to controlling diseases and pests in the field. In addition to the poly-culture technique, the survey showed that the farmers practice crop diversification techniques by cultivating different types of crops at specific locations in the Chena.

**Table 4: Number of crops grown in Chena cultivation: Indigenous vs. Modern**

<table>
<thead>
<tr>
<th>Indigenous Chena</th>
<th>Modern Chena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice, Finger millet (Kurakkkan), Sesame (Tala),</td>
<td>Maize, Green gram, Cowpea Papaya,</td>
</tr>
<tr>
<td>Green gram (Mun), Cowpea, Black gram (Kalu kadala),</td>
<td>Banana, Water Melon</td>
</tr>
<tr>
<td>Maize (Iringu), Black lentil (Udu), Kodo millet (Amu),</td>
<td></td>
</tr>
<tr>
<td>Mustard (Aba), Cumin (Duru), Foxtail mille (Thana hal),</td>
<td></td>
</tr>
<tr>
<td>Horse gram (Kollu), Pumpkin, Cucumber, Tibbatu</td>
<td></td>
</tr>
<tr>
<td>(Solanum indica, s.), Eggplant, Spine gourd, Bitter</td>
<td></td>
</tr>
<tr>
<td>gourd, Ribbed gourd, Chili, Okra, Tomato, Long bean,</td>
<td></td>
</tr>
<tr>
<td>Kakiri, Sweet potato, Cassava Papaya, Banana,</td>
<td></td>
</tr>
<tr>
<td>Source: Field Survey, 2018</td>
<td></td>
</tr>
</tbody>
</table>

3.2.5 Land use and crop management techniques

One of the main arguments for neglecting the indigenous Chena cultivation technique is its low yields and, thus, lesser ability to support household food security. The analysis of our field survey data on the indigenous Chena cultivation system provides evidence against this argument.

The first step in land management practices is the assessment of land that is suitable for each crop. For example, in rice Chena, the farmers select the kayan polowa, where kayan trees grow. Kayan trees generally grow in lowlands where the water content and retention capacity are relatively high. Likewise, the identification of suitable land is basically carried out by the farmers using specific environmental indicators, such as specific trees, grasses or types of soil. Once land has been assessed, the farmer applies crop management techniques to achieve diverse objectives including pest and disease control, enhancing cropland productivity, securing the year-round household food consumption, optimizing rain water utilization and avoiding wild animal attacks. For instance, there are specific crops that grow close to fences, such as coriander (koththamalli) (see Figure 3—B). The reason for growing coriander is not
only household consumption, but also to ward off wild pigs and other animals, as they strongly dislike eating coriander. Crops such as bitter gourd, chena gourd, sponge gourd, battle gourd and ash gourd are usually grown near the fence and later directed toward the fence (see Figure 3, —A). As discussed in the previous section, poly-culture and diversified cropping structures are applied in the remainder of the land. Rice is grown in lowland areas of the Chena, where there is a relatively high water level in the land, mostly at the lower boundary of rain water channels (Ara) (see Figure 3, —C). Finger millet, together with other specific crops, is generally grown at the upper boundary of the rain water channel (see Figure 3, —D). The purpose of applying the poly-culture technique in finger millet cultivation is to provide an advantageous environment for finger millet, which is the main crop in the selected plot of land. The harvesting of the other crops in the finger millet plot does not take place at the same time but occurs much earlier than finger millet harvesting. Thus, the farmers must walk within the finger millet plot from time to time for harvesting, which helps finger millet to grow well. Okra, corn and green chili are grown around the thumbasa because of the good soil conditions for these crops (see Figure 3, —E). Specifically, around corn plants, the farmers generally tend to grow long beans because corn plants become a support crop for long beans. Cassava, papaya and banana are grown in different areas of the Chena (see Figure 3, —F). The harvesting period for cassava falls within the off-season, specifically in the dry period of the year, and this crop therefore becomes an important food for the farm household during the food shortage period. The rest of the area is used to grow many different types of crops, such as green gram, cowpea, black gram, maize, black lentil, kodo millet and water melon (see Figure 3, —G). Yam varieties, some cereals, tomato, leafy vegetables and some other essential foods for the household are grown around the cottage in the Chena (see Figure 3, —H). The purpose of growing these crops around the cottage is to protect them from animals such as monkeys and birds. These unique techniques of land and crop management applied in Chena cultivation enhance cropland productivity and thereby provide evidence countering the low yield argument. These techniques have diverse objectives, as described in this section, which are not practiced in modern agriculture.

<table>
<thead>
<tr>
<th>A: Bitter gourd, Chena gourd, Sponge gourd, Bottle gourd, Ash Gourd</th>
<th>B: Coriander (koththamalli)</th>
<th>C: Rice</th>
<th>D: Finger millet, thiyabara, chili, aba, amu, meneri</th>
</tr>
</thead>
<tbody>
<tr>
<td>E: Okra, corn, green chili</td>
<td>F: Manioc (cassava), papaya, banana</td>
<td>G: Green gram (Mun), Cowpea, Black gram (Kalu kadala), Maize (Iringu), Black lentil (Udu), Kodo millet (Amu), water melon</td>
<td>H: Yams varieties, some cereals, tomato, chili and some leafy vegetables.</td>
</tr>
</tbody>
</table>

Figure 7-3 Schematic representation of indigenous Chena —Mulkata Chena

7.4 Concluding remarks: Lessons learned in relation to contemporary problems in modern agriculture
The purpose of this study was to identify lessons that can be learned from the indigenous Chena cultivation techniques to address contemporary agricultural problems.

First, as cited in the literature, environmental problems are the main concern of contemporary agricultural technology, due to the heavy usage of agrochemicals. In this context, our analysis of indigenous Chena cultivation techniques revealed that agriculture can be carried out without agrochemicals, with a proper understanding of the natural system. In particular, the direction of the movement of sunrays and the lunar calendar provide a great deal of evidence regarding the natural growth patterns of crop plants. These two nature-bound indicators correlate with the rainfall patterns in the region. The experience of the farmers has revealed the importance of these three factors for vigorous plant growth. It is assumed that if the timing of rice plant pollination falls around the 21st of December in the Maha season and the 21st of June in the Yala season, the yield will be increased by 16% from the average yield (Field interview with Thilak Kandegama, 2018). The adopted poly-culture cropping technique helps to minimize pests and control disease in the field, indicating that the farmers can use certain crop varieties to control pests and disease in the field. In particular, the farmers use indigenous seed varieties almost exclusively. These varieties are not responsive to modern agrochemicals and are highly resistant to pests and disease. Taken together, this indigenous knowledge demonstrates that agriculture can be carried out without polluting the environment.

Second, as cited in the literatures, modern agricultural technology has led to a high cost of production and therefore an insufficient net income for farmers to access the food market. In this context, the analysis of indigenous Chena cultivation provides two types of solutions: minimization of costs and maximization of cropland productivity. Specifically, nature-bound techniques, such as the application of timely cultivation and the lunar calendar and rain calendar, and the poly-culture cropping technique avoid agrochemical costs, which represent a large share of the cost of modern agriculture. On the other hand, the poly-culture and diversified cropping techniques enhance cropland productivity and support the production of the numerous food varieties required for household consumption throughout the year. This study demonstrated the fallacy of the low yield argument regarding indigenous agriculture, as the applied crop and land use management practices support high production by farmers, considering all of the crop varieties that are cultivated, at relatively low cost compared with the monoculture-based Chena system in the country.

Third, food safety and farmer safety are widely questioned under modern agricultural practices. This is one of typical concerns in Sri Lanka, as the WHO has found agrochemicals to be the major cause of an as yet unidentified kidney disease problem in the major agricultural regions of the country. In particular, the use of agrochemicals in modern Chena cultivation has been identified as the main cause of health issues among affected farmers. Thus, it is important to learn the special characteristics of indigenous Chena farming technology, as it has supported a healthy society for thousands years in Sri Lanka. As described above, the indigenous technology applied in Chena cultivation first avoids the usage of agrochemicals in agricultural land. Second, the technology supports to the production of many types of food by the farm household, due to the poly-culture cropping technique and diversification practices (see Table 4). Thus, these Chena techniques support a healthy and safe food consumption pattern among farm households, which clearly affects the household dietary intake, and there is therefore high support for securing household nutritional conditions and balance. These characteristics of indigenous techniques of Chena cultivation provide sustainable solutions for the contemporary health problems associated with modern technology because modern technology is biased towards several market-oriented crops, such as rice and maize. This is a very important finding of this study because, as cited in the literature, the change in food consumption patterns is the one of the reasons for the current health issues observed in the agrarian structures of Sri Lanka (Silva, 2014). Third, one of the main techniques adopted in indigenous Chena cultivation is the use of indigenous seeds for all crop varieties. The farmers traditionally maintain an indigenous seed bank within the household each year. In particular, it can reasonably be assumed that there is an association of the emerging health issues within the transformed agrarian structures, particularly in the survey district, with the change in seed varieties from indigenous varieties to high-yield varieties (HYVs) and the change in household dietary patterns, as indigenous varieties exhibit numerous medicinal properties, for example, in relation to cancer, diabetes and kidney problems.

Fourth, the application of the rain water utilization technique for crop plant growth provides another important solution to the contemporary water shortage problem in farming. Indigenous Chena is entirely dependent on rain. As described in the analysis, farmers traditionally know about the yearly rain calendar in the region. The pattern of crop planting is usually determined taking into account each step of the rainfall pattern and the length of the life cycle of each crop. For instance, finger millet is cultivated in association with Ak rain, but the cultivation of rice and other crops begins with the north-eastern monsoon. Moreover, the water utilization of each crop in the Chena is determined by assessing the suitable land for each crop by taking into account several environmental indicators, indicating that indigenous farmers apply a diversified water utilization technique to sustain Chena farming in each season. This
situation is quite different from modern water management techniques because the modern technique of water management is unique to the region and all crop varieties and does not take into account the rainfall pattern in the region. Thus, this study indicates the importance of taking into account these characteristics of indigenous Chena cultivation technology to address contemporary agricultural problems. As there are some specific limitations in promoting Chena cultivation in Sri Lanka and the complexity of the current challenges regarding the food supply, researchers must at least, acknowledge these historically developed micro-technologies applied Chena cultivation to find an alternative solution for the contemporary problems in agriculture. Such an acknowledgement will help to enhance local food production in a safe and sustainable way.

References


Maternal Mortality Rates and Health Status of Women: A Block Level Study in Hojai District of Assam

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Abstract: Health is an important component for achieving physical peace and happiness of an individual. The present study has focused on the health status of women by considering the maternal mortality rates as an indicator in selected district of Assam. Purposive sampling technique has been used to select the desired sample population. This study is based on both primary and secondary sources. The predetermined objective of the study has been fulfilled by using descriptive statistical tools and techniques. We have observed that besides the health related factors some social occurrences like religious belief, economic conditions, food habits, social customs, early motherhood, effective marriage age, educational attainment of pregnant women are accountable for the growing maternal deaths.

Index Terms: Health Status, Maternal Mortality, Religious belief, Early Motherhood, etc.

1. Introduction

Health is the most important assets than anything in one’s life. Healthy life brings peace, prosperity and happiness to an individual. In common perspective good health implies free from any kind of diseases related with physical and mental conditions of an individual. Ensuring better health facilities to its citizens is the prime importance for the modern welfare states. Therefore government have allocated sufficient amount of public money for providing better health infrastructure facilities in the entire country. Improved health condition has increased the economic prosperity of an individual through increasing his or her capacity to involve in an economic activity and decreased the chances of morbidity as well as mortality. It has been proved that the higher life expectancy at birth has associated with the higher per capita income in developed nations.

In our present discussion, we are concerned with the health status of women which is 48.5% of the total population and the workforce participation rate is 25.51% against 53.26% against males. (Census census 2011)
Women occupy nearly half of the total population of our country. They are providing workforce to the nation and at the same time brings future generations. Therefore, ensuring better health condition to the women is the prime focus of every nation in the present world. To measuring health status of women is a complex phenomenon. The most common and widely used indicators of measuring health status is life expectancy at birth, infant mortality rate, birth rates, death rates, maternal mortality, disability adjusted life years including incidence of malaria etc. (World Heath Statistics). Among the various indicators, we are considering one indicator which is Maternal Mortality Rates to measure women health. Maternal mortality means the “death of a woman while pregnant or within 42 days of termination of pregnancy” (WHO, 2004) While the maternal mortality ratio is the ratio of number of maternal death during a given period per 1, 00,000 live birth. On the other hand, maternal mortality rate is the number of maternal death during a given period per 1, 00,000 of women at reproductive age. (WHO, 2010)

The risk of dying from the causes associated with child birth and other complications of pregnancy are measured by the maternal mortality rate. Such type of female death arises from puerperal causes (Sinha et al. 2019). Death occurs during the reproductive age group 15-49 is an important determinant for the health status women.

Health status of women is different across states, regions and on the basis of the religious beliefs of people. The present paper has focused on women health status in the state Assam as a whole and especially to a particularly one district i.e. Hojai. According to the Census of India 2011, the total population of Assam stands at 3,12,05576 person out of which 1,52,66133 female and 15939443 male with a density of 398 person per square and an average 72.2 percent literacy level. Assam has posses a strong demographic position both in terms of total as well as female population size.

1.2 Objectives of the study
This study has concentrated on the following objectives.

a. To examine the maternal mortality rates of Assam with few other states of India.
b. To examine the maternal mortality rates and institutional delivery rates in the selected study area.
c. To measure the health status of pregnant women in terms of hemoglobin level, body weight and number of birth order in the selected population.

Hypothesis
There is association between the age groups of pregnant women and their level of hemoglobin.

2. Review of Literature
We have reviewed few selected theoretical and empirical literatures to clear the concept related with the study. The above mentioned objectives are set after going through those literatures. Kamalapur et al. (2013) has mentioned that the women health status depends on the social status of women. The researcher has mentioned that the widespread ignorance about health related matters; low levels of literacy, limited exposure to mass media and access to money are responsible for poor health status. Kushwah (2013) has found that educational attainment level of women and place of residence has direct role in morbidity and mortality in our country. It has mentioned that women resides in rural places has received less medical facilities than in urban places. Joe et al. (2015) observed that economic growth does not commensurate with the maternal mortality rates. It has been observed that investment is important for strengthening the health system, education and empowering women. Singh et al. (2018) have observed that not only the hospital based factors but also some social factors are increasing mortality rates in our country. Their studies have shown that socio-economic disparity, rural-urban differences, education level of women, caste and gender-based inequity etc. are a real hurdle to any attempt made to reduce maternal deaths in the country.

3. Methodology

3.1 Selection of the study area

In the year 2015, Government of Assam has bifurcated five new districts from the existing districts. In the initial stage, among the five districts, we have purposively selected one of them considering the population size and ratio of female population.

The newly formed Hojai district is one among the five districts. In terms of population size, this district is one of the largest districts of Assam. (Total population 9,31,218 and 48.8% Female Source: Office of the Registrar General of India and Census Commissioner, 2011) The density of population in the district is 885 persons, (per square kilometer) higher than the state as a whole. Therefore in the second stage, we have selected Hojai district as the study area.

National Rural Health Mission (NRHM) has divided the district into three Health Development Blocks i.e. Jugijan, Lanka and Kathiatali. In the third stage, we have selected Jugijan Block because it has covered 3,67,288 population which is nearly forty 40% of the district population. Besides these, that block has registered highest number of pregnancy and maternal death in comparison to the other two blocks in the district.

3.2 Selection of Primary Health Center
The Jugijan Block has been classified into twenty eight (28) Primary Health Centers. In the fourth stage, we have selected the Primary Health Center from the Block. Primary Health Centers are selected on the basis of the number of recorded pregnant women and number of maternal and infant deaths rates in the last five years. Among the health centers we have found that the Hojai Public Health Center (PHC) cum First Referral Unit (FRU) has recorded highest number of pregnancy in the last five years along with the number of infant death rates as well as maternal deaths. Therefore, Hojai Primary Health Center has been selected in the present study.

3.3 Selection of sample population

We are concerned with the health status of women during pregnancy period. The selected health center has covered 3 villages namely Kulibasti 1, Kulibasti 2 and Gopalnagar including 6,320 number of population. Among the three villages Kulibasti 1 and Kulibasti 2 has recorded highest number of pregnancy rates in the last five years. In the year 2019-20 the total 91 pregnancy cases registered in the respective villages. This is recorded as the highest in number in comparison to the others. Therefore, in the final stage, we have selected the above mentioned villages and required information has been collected through Anganbadi, ASHA and ANM engaged in the sample villages. The total number of sample size is low therefore as a rule of thumb, we have collected primary information related with our study in all the pregnant women from both the villages in the year of 2019 and the early period (January to March) of 2020.

3.4 Data Sources

The present paper is purely based on primary as well as secondary data. Primary information is collected from the selected sample population ASHA worker Auxiliary Nursing Midwifery (ANM) incorporated in the selected area. The secondary information are collected from the published report by Central and State government at different time period. We have focused on the NITI Aayog report about the already selected indicator for determining women health status in the study area.

3.5 Tools and Techniques

Considering the first objectives of the study, we are using cross tabulation and graphs to compare the maternal mortality rates of Assam with the other selected states of our country. Multiple Bar diagram has been used to show the difference between institutional delivery in different year period and the effective age of
marriage of women with the maternal mortality rates. We calculate Maternal Mortality Ratio and Neonatal Death Rates of the Juginan block by using the standard formula as mentioned below.

\[
\text{MD} \\
\text{Maternal Mortality Ratio (MMR) = } \frac{\text{Number of Infant Death}}{\text{Births}} \times 100000 \\
\text{Neonatal Death Rate = } \frac{\text{Number of Live Birth}}{\text{Number of Infant Death}} \times 1000
\]

Tabular presentation and percentage method has been used to analyze the second objective of the study. Spearman’s Rank Correlation technique has been used to examine the relationship between the number of birth order and educational attainment of the pregnant women in the study area.

To accomplish the third objective of the study, we have chosen pie chart to represent the hemoglobin level among the selected sample population. Chi-square test has been used to measure the level of hemoglobin among the different age group of pregnant women.

4.1 Maternal Mortality Ratios in Assam and Selected States of India

The maternal mortality rate is a crucial factor to determine the women health status of a country. In the very outset, we are reviewing the maternal mortality rates of Assam in the last few years and make a comparison to other states of our country. Such comparison is made to clear the present position of our state that has reflected the health status enjoyed by the women. The selection of states is made on the basis of HDI rank and size of population. Those states are classified into three categories i.e. higher, medium and average stage of human development during the year period 2016-17.

We have compared the maternal mortality ratio of Assam with a few developed states considering the attainment level of human development stages. States are classified into higher, average and lower HDI rank attained in the last three year period. Those selected states are Maharashtra, Tamil Nadu (High HDI) West Bangle, (Medium HDI) Bihar and Uttar Pradesh Average HDI). It has been found that the maternal mortality ratio is low among the higher human development states than the medium and average states.

Table no. 1: Maternal Mortality Ratio in Assam and Selected States of India

<table>
<thead>
<tr>
<th>S.N</th>
<th>Name of the State</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2010-12</td>
</tr>
<tr>
<td>1</td>
<td>Maharashtra (High HDI)</td>
<td>87</td>
</tr>
<tr>
<td>2</td>
<td>Tamil Nadu (High HDI)</td>
<td>90</td>
</tr>
</tbody>
</table>
Assam having an average HDI rank has received significantly higher mortality ratios in comparison to Bihar and Uttar Pradesh with similar human development rates. It has reflected a poor health status enjoyed by the women in our state during their crucial time of life. There are several factors responsible for such poor health status that includes inadequate medical infrastructure and health care facilities, lack of awareness about health related information, religious beliefs, socio-cultural and institutional factors etc. The first objective of our study has examined through the above discussions.

As we have mentioned that the maternal mortality ratio is influenced by various factors including women health related factors, medical infrastructure and some other social factors. Among those factors, we have considered mainly two factors namely effective age of marriage among women and institutional delivery (Hospital Delivery) rates in percent of the total in Assam. One is related with socio-cultural views and other is with the availability as well as accessibility of health infrastructure facilities. Secondary information is collected about social factors that has related with the maternal death.

We have observed from the table and diagram given below that maternal death rates and the institutional delivery percentage of women has opposite relationship in the year period. The maternal death rates decreases in those states where the rates of hospital delivery is high. Thus our second objective has been accomplished and we can consider that the increasing number of institutional delivery (Hospital Delivery) can reduced the chances of maternal death rates.

Table no 2: Socio Cultural factors and MMR of the selected states of India
We have observed the effective age of marriage of women and the maternal deaths. In most of the developed nations the mean marriage of female is 24.9 whereas, in less developed countries female marriage age is 21.4. In our study we have compared the trend of maternal death rates with the female marriage age. It reveals that the states like Tamil Nadu having highest female marriage age have lowered the maternal death rates during 2014-16 periods. States like Bihar and Assam have lower female marriage age has increased maternal death rates. Thus maternal death ratios can be reduced through increasing the effective age of marriage. As the lower age of female has a greater chance of maternal deaths.

4.2 Maternal Mortality Ratio in Selected Sample Area

In the selected sample block Jugijan under Hojai district has covered 3,67,288 population. The total number of pregnancy and maternal death registered in the last three years are shown in the table below.

Table no. 3: Maternal Health in Survey Block 2019-20, Assam
(Number of Hospital Delivery included Govt. Hospitals and Private Nursing Homes)

<table>
<thead>
<tr>
<th>S N</th>
<th>Year</th>
<th>Pregnancy Recorded</th>
<th>Govt. Hospital Delivery</th>
<th>Home Delivery</th>
<th>Private Hospital</th>
<th>MD</th>
<th>MMR</th>
<th>Infant Death</th>
<th>NND</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2016-17</td>
<td>8797</td>
<td>6480</td>
<td>537</td>
<td>6.10%</td>
<td>1780</td>
<td>20%</td>
<td>11</td>
<td>156</td>
</tr>
<tr>
<td>2</td>
<td>2017-18</td>
<td>8536</td>
<td>6541</td>
<td>526</td>
<td>6.16%</td>
<td>1469</td>
<td>12%</td>
<td>11</td>
<td>155</td>
</tr>
<tr>
<td>3</td>
<td>2018-19</td>
<td>8302</td>
<td>6517</td>
<td>362</td>
<td>4.36%</td>
<td>1423</td>
<td>17%</td>
<td>09</td>
<td>130</td>
</tr>
</tbody>
</table>

Source: Field Survey, Jugijan block, 2019-20

We have observed that the number of maternal mortality has decreased with the increase in percentage of hospital delivery. On the other hand the neonatal death rate is high in that block. The high neonatal and maternal deaths rate have influenced by medical infrastructure related as well as socio-cultural factors. In the present study the nature of health infrastructure facilities in the selected block of the district has been observed.

**Table no. 4**

<table>
<thead>
<tr>
<th>S.N</th>
<th>Types of Facilities</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Number of Health Center</td>
<td>28</td>
</tr>
<tr>
<td>2</td>
<td>Number of Medical Officer</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Number of Lady Medical Officer</td>
<td>03</td>
</tr>
<tr>
<td>4</td>
<td>Gynecologist</td>
<td>03</td>
</tr>
<tr>
<td>5</td>
<td>Lady Gynecologist</td>
<td>01</td>
</tr>
<tr>
<td>6</td>
<td>Obstetrics</td>
<td>03</td>
</tr>
<tr>
<td>7</td>
<td>GNM</td>
<td>22</td>
</tr>
<tr>
<td>8</td>
<td>ANM</td>
<td>64</td>
</tr>
<tr>
<td>9</td>
<td>ASHA</td>
<td>294</td>
</tr>
<tr>
<td>10</td>
<td>Anganbadi</td>
<td>530</td>
</tr>
<tr>
<td>11</td>
<td>Delivery Table/Bed</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>Baby Incubator</td>
<td>04</td>
</tr>
<tr>
<td>13</td>
<td>Blood Bank</td>
<td>01</td>
</tr>
</tbody>
</table>

Source: Field Survey, Jugijan Block, 2019-20

It reveals through the primary investigation conducted during the study that the health infrastructure facilities are inadequate as the number of medical practitioner available is more than one thousand. (WHO norms 1:1,000 doctors) The insufficient number of physician has negatively influenced in female health care facilities as well as decreased the rates of institutional delivery. On the other hand, availability of Gynecologist is very small in number. The other related facilities like delivery bed, baby incubator, blood bank etc. which are inadequate in comparison to the total population size. Thus the heath infrastructure is inadequate in nature which is become an important factor for the increasing rates of infants and maternal deaths.
4.3 Health Status in Selected Sample Village

Our study has been carried out in the two urban (basti) areas namely Kulibasti 1 and Kulibasti 2. The total population of the two areas is 2100 and 1540 and the total eligible couples in both the villages are 219 and 108 number. We have found that the mean age of pregnancy among the married women is 23.18 years. It implies that the marriage age of the women is lower than the pregnant age. Thus the women got married at an early age and have greater risk of maternal and neonatal deaths. We have received information during field survey that the women at the age of 19 become pregnant which has indicates the negative influence of socio-cultural beliefs as well as lack of awareness about health.

Table no 5: Results of Descriptive statistical analysis, 2019-20

<table>
<thead>
<tr>
<th>S.N</th>
<th>Results</th>
<th>Age of the pregnant women</th>
<th>Hemoglobin Level (Per/DL)</th>
<th>Weight (In K.G.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total Number of Observation (N)</td>
<td>91</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>2</td>
<td>Mean (Average)</td>
<td>24.18</td>
<td>9.72</td>
<td>44.65</td>
</tr>
<tr>
<td>3</td>
<td>Standard Deviation (SD)</td>
<td>3.175</td>
<td>0.756</td>
<td>4.68</td>
</tr>
<tr>
<td>4</td>
<td>Variance (V)</td>
<td>10.79</td>
<td>80.46</td>
<td>21.98</td>
</tr>
</tbody>
</table>

Source: Field Survey data, 2019-20

In order to accomplish the third objective of the study we are analyzing the relationship of birth order, educational qualification and family income level. The birth order has been classified into three categories. If the number of birth is one then it is considered as low birth order and if it is two then average, and if it is three and above than it is high birth order. Similarly, educational qualifications are classified as illiterate, literate, upto class VIII, up to H.S Passed, up to Graduate and above. Incomes of the respondents are classified as below poverty (BPL Card Holder) above poverty, middle income and rich class.

To observe the nature of relationship among the categorical (ordinal) data we are using the Spearman’s Rank correlation. We observed that the educational qualification with birth order has negative and significant relationship. The high birth order has influenced by the low educational level of the pregnant women in the study area.

Table no 6: Spearman’s Rank correlation results

( Educational Qualification and Family Income & Birth Order )

<table>
<thead>
<tr>
<th>S.N</th>
<th>Results</th>
<th>Family Income</th>
<th>Birth Order</th>
<th>Birth order &amp; Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total number of Observation (N)</td>
<td>91</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>2</td>
<td>Strength of the relationship</td>
<td>0.580</td>
<td>-0.381</td>
<td>-0.339</td>
</tr>
<tr>
<td>3</td>
<td>Level of Significance (p-value)</td>
<td>0.001**</td>
<td>0.001**</td>
<td>0.001**</td>
</tr>
</tbody>
</table>

** Correlation is significant at 0.01 levels
Similarly, birth order and income level has negatively significant. The number of birth order has decreased with the increase in income level of the family. The poor family has the possibility of high birth order and low level of education. The high birth order and poor income level has decreased hemoglobin level and increased the chances of maternal and neonatal deaths.

Fig 3: Pie chart of Hemoglobin level of pregnant women

![Pie chart of Hemoglobin level of pregnant women](source)

The hypothesis of the present study has been tested by using chi-square test through classified different age group of pregnant women and their hemoglobin level. The calculated value of chi-square is 1.84 less than tabulated at 5% level. Our analysis shows that there is no such kind of association between the age groups of the pregnant women and their level of hemoglobin. We have observed that 58.24% of the total pregnant women have less than the normal range of hemoglobin. They have the chances of suffering from anemia in the later stage of the duration. As it has been proved that the anemia is a common symptom during the stage of pregnancy and the cause of maternal deaths. The greater number of women having low level of hemoglobin indicates the poor health and nutritional facilities.

5. Conclusion

Health lifestyle, good habits and knowledge about health is important enough besides the availability of health infrastructure facilities. In a state like Assam the rapidly growing population pressure and lack of popularity and adaptability of family planning measure has resulted greater prospects of increasing deaths among women and child during their critical period of life. Proper education about health and nutrition, number of birth order, age of pregnant women and economic condition are important issues that become significant in reducing maternal and neonatal deaths. The medical facilities along can’t resolve such a big issue. Public awareness regarding different health related challenges is a better medicine for improving overall health status of our society.
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Effects of Loan Structure On the Performance of Micro-Enterprises in Uasin Gishu County, Kenya

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Abstract
The importance of loan structure has not been emphasized by microenterprises when it comes to management of loan risks and performance of the microenterprise. The study therefore investigated the effect of loan structure on the performance of microenterprises in Eldoret Town, Kenya. The specific objectives guiding the study are to evaluate the effect of installments on the performance of microenterprises in Kenya, to determine the effect of repayment period on the performance of microenterprises in Kenya, to find out the effect of loan interest on the performance of microenterprises in Kenya and to establish the effect of loan security on the performance of microenterprises in Kenya. This research was guided by three theories; the Pecking Order Theory of Financing, Adverse Selection Theory of Financial Markets and Ex Ante Theory of Collateral. This study adopted descriptive survey research design. The target population of the study was 2508 registered enterprises and the sample size was 334 respondents. The study used questionnaires as the main tool for collecting data. The study used structured questionnaire to collect primary data. Pilot study was done among micro-enterprises in Kitale town by distributing 34 questionnaires representing 10% of the total sample size. The collected data was analyzed using Statistical Package for Social Science (SPSS) version 20. Quantitative data was analysed using both descriptive and inferential statistics. Descriptive statistics included frequencies, means, mode, standard deviation, variance and percentages. Inferentially data was analyzed using correlation and multiple linear regressions. Pearson Product-Moment Correlation Coefficient and regression analysis was used in order to test the relationship between the dependent and independent variables. This study was significant to the government since used the findings of this study by bringing into light various policies and regulations to enact in order to help in the growth of microenterprises in Kenya. The study findings revealed that installment period had a positive and statistical significant effect on performance of microenterprises ($\beta=0.228$, $p<0.05$), repayment period had a positive and statistical significant effect on performance of microenterprises ($\beta=0.201$, $p<0.05$), loan interest had a positive and statistical significant effect on performance of microenterprises ($\beta=0.136$, $p<0.05$) and loan security had a positive and statistical significant effect on performance of microenterprises ($\beta=0.196$, $p<0.05$). In conclusion installment repayment greatly dependent on loan size which is used to determine spread of repayment which is usually monthly basis. Repayment period with adjusted or extended terms help microenterprises do better because they can generate enough profit to assist in offsetting the expenses and debts owed. Creditors need loan security before issuing out loans and the challenge to microenterprises is that they lack collateral. The study recommends to microfinance institutions who lend money to microenterprises to consider reviewing installment payment extended to three months from the usual one month. The study further suggests an evaluating to be done on the effect of installment payments on performance of microenterprises in the banking sector.

Key Words: Loan Structure, Micro-Enterprises Performance, Pecking Order Theory, Payback Period

INTRODUCTION
Background of the Study
Performance of microenterprises are measured by its financial status and that an accurate and standardized performance information is imperative, both financial information and social information (Kahsay & Zeleke, 2019). Further, MFIs, donors, investors, bank supervisors and customers’ need this information to judge their cost, risk and returns. Ahmad, Sipon, Yousof, Nur’Asyiqin Ramdhan, Hasan, Abdullah and Mohamed (2018) highlight six major indicators of microenterprises performance. They include: Portfolio quality, productivity and efficiency, financial viability, profitability, leverage and capital adequacy scale, outreach and growth. The essence of calculating and analyzing performance indicators (ratios) is to provide information that may help improve microenterprises financial performance (Kosgei, 2019). Loan structure is about putting in place the structure, processes and mechanism that may ensure the microenterprises is being directed and managed in a way that enhances long-term equity value through accountability of managers and enhancing organizational performance, (Viswanath, 2018). Therefore, capital structure is a set of rules and incentives by which the management of microenterprises is directed and controlled, hence, sound capital structure have effects on profitability and long-term value of the firm for shareholders. Microenterprises performance and capital structure has succeeded in attracting a good deal of public interest because it is a tool for socio-
economic development. Also when there is good firm performance and capital structure, there was proper and efficient practice in the administration of business entities. The choice between debt and equity for a business firm has implications on the value of a firm as well as strategic importance for corporate managers (O’Leary, 2017).

The impact of capital structure on the performance of microenterprises shows that most of the microenterprises use high leverage and finance their operations with long term as against short term debt. Also highly leveraged microenterprises perform better by reaching out to more clientele, enjoy scale economies, and are therefore better able to deal with moral hazard and adverse selection. ROA and ROE is used as performance indicators, and total debt, short term debt and long term debt are used as indicators for capital structure of MFI. As control variables size, age and risk level are used. At the heart of capital structure decisions is the search for the optimal capital structure which is the level of capital that maximizes profitability and shareholders’ value (Van Hoang, Gurau, Lahiani & Seran, 2018).

Globally, microenterprises have evolved as an economic development approach intended to benefit both low income men and women. Financial services include loans and savings; however some organizations also provide insurance and payment services. Thus, microfinance includes not only microcredits but also other financial services, which can be offered to the poor. Interested economists found soon that not only small credits but also other services connected with lending could improve economic lives of the poorest (Chu & Luke, 2018).

In Australia, capital structure of a microenterprise is basically a mix of debt and equity which a microenterprise deems as appropriate to enhance its operations performance. Capital structure decision is the choice of a firm’s mixture of sources of financing, made up of debt and equity financing (Van Hoang et., 2018). Microenterprises capital structure decision is the choice of how much debt a firm should have relative to equity. The capital structure is a reflection of a firm’s borrowing policy. It refers to the mix of long term debt and equity financing. Therefore, capital structure is deemed to have an impact on a microenterprises performance against the position. The high leverage or low equity/asset ratio reduces agency cost of outside equity and thus increases firm value by compelling managers to act more in the interest of shareholders (Charman, 2017).

In Canada, Microenterprises make a significant and long-term contribution to improving the access of finance to the poor residents and make them financially inclusive. Microenterprises need to know more about factors that may help these institutions reach their financial and social goals. Aiming at maximizing outreach under the condition of being financially sustainable is certainly important, as many MFIs nowadays are still dependent on subsidies from governments and NGOs. It is hard for MFIs to achieve their goals if they are not performing well financially. Capital structure decisions are an important factor for firm’s performance. Microenterprises has proven to be an appropriate, effective and powerful tool for the poor and for poverty reduction in order to reach the Millennium goals (Mohammed & Uraguchi, 2017).

In the Middle-East and Iraq, loan structure is the vital tool on performance of microenterprise since the profitability of an enterprise is directly affected by loan structures. The successful selection and use of capital is one of the key elements of the firms’ financial strategy. Profitability should be re-invested into the business for its’ survival where, profitability is the most prominent issues in the world of corporate finance literature, and the ultimate goal for any firm is to maximize profitability. However, too much attention paid to profitability, which may lead the microenterprise into a pitfall by diluting the liquidity position of the organization (Arezki, Belhaj & Shah, 2019). Microenterprises are basically a long-term process which tends to support the poor financially so that they can combine their skills, knowledge, experience and financial capital to break away from poverty and change their lives. Therefore, access to commercial funds is likely to encourage microenterprise to move out of heavily subsidized operations and to enter into commercialization in order to achieve efficiency and sustainability. The control of loan structure enabled microenterprises to continue making improvement in their performance. This is therefore necessary for all micro institutions (Kuada, 2019).

Sub-Saharan Africa, microenterprises tend to report lower levels of profitability, as measured by return on assets, than microenterprises in other global regions. Among the African Microenterprises that provided information for this study, 47 per cent post positive unadjusted returns; regulated MFIs report the highest return on assets of all MFI types, averaging around 2.6 per cent. The microfinance sector in Africa is quickly expanding, and institutions have increased their activities. In fact, African Microenterprises are among the most productive globally, as measured by the number of borrowers and savers per staff member. Microenterprises in Africa also demonstrate higher levels of portfolio quality, with an average portfolio at risk over 30 days of only 4.0 per cent. However, operating and financial expenses are high, and on average, revenues remain lower than in other global regions. Efficiency in terms of cost per borrower is lowest for African microenterprises (Nwaokoro, Ojemakinde & Washington, 2017).

In Cameroon, the capital structure decision of a business is important because a poor decision can affect a microenterprises profitability leading to a decrease in shareholders’ value and vice versa. The overriding objective of financial decisions is to maximize the wealth of shareholders (Cosgrove, 2018). In other words, the objective of a firm’s financial decisions is to increase its profitability and the value of its shares. The effect that capital structure decisions have on profitability and firm value is that, it increases value through the present value of tax savings from the use of debt. Intuitively, this may imply that firms should use 100% debt to maximize their value. However, excessive use of debt may lead to a reduction in value because of the increasing possibility of financial distress and possible downgrading of the firm’s credit rating. Therefore the possible effects of capital structure policy are that it can increase both gains and losses of the firm (Taiwo, Alege & Olokoyo, 2016).

Similarly in Ghana, in microenterprises short term debts are less expensive as compared to long term debts leading to an increase in profit levels. Short term debt has a significant positive relationship with Return on Equity and long term debt has a significant negative relationship with return on Equity.
In Uganda, microenterprises show that grants and debt have a substantial damaging consequence on MFI performance. When sustainability was more constricted to financial sustainability, debt and share capital remained noteworthy. Other than grants, debt was paid back on competitive market interest rates, whereas share capital fetched in revenues to the MFIs at market interest rates from the borrowers. The Microenterprises industry in Kenya is growing at a very rapid rate. While East Africa is at an earlier stage of competition, the major urban centers in Kenya, are becoming saturated by competition among numerous MFIs (Eberhard-Ruiz & Moradi, 2019). From an economic perspective competition means more firms are competing for a limited market share and thus having to adjust ever closer to the needs of the customers as well as lowering prices down to a point where marginal revenue equals marginal cost. According to Omare (2019), 25% of borrowers in microfinance institutions take loans from six or more different financial institutions which eventually lead to repayment crisis in the microfinance industry. Microenterprises with a relatively high portfolio to asset ratio may be at greater risk of failure.

In the year 2012, the main source of funding for enterprises was only microfinance institutions through borrowings, which accounted for 54.2%. Compulsory deposits accounted for 22.5% of the loan structure, which was a decrease from 28.8% in the year 2011 (Bengi & Njenje, 2016). The change in deposits and debt influence the capital structure of microfinance institutions. Whether the loan structure in Depository Microfinance Institutions influence financial performance has not been empirically determine. Understanding the role of DMFIs' Loan structure and its composition, whose knowledge largely misses in the literature, constitutes a knowledge gap in Kenya, hence studying the field was critical. Mainly this study sought to investigate on the effect of loan structure on the performance of microenterprises with a case of taking microfinance institutions.

Statement of the Problem
Performance of microenterprises is often used indiscriminately to describe everything from efficiency to effectiveness. Improving the performance of the microenterprises is a central concern and the speculation about the factors related to organizational effectiveness is necessary in the modern society. Unfortunately, little effort has been made to look at those factors empirically. Further, the importance of loan structure has not been emphasized by microenterprises when it comes to management of loan risks and performance of the microenterprise (Gámez & Aguirre, 2019).

Similarly, in Eldoret town a number of microenterprises have failed to prosper because they cannot repay their loans on time thus end up being forced to shut down and quit the market due to limited capital. The key problems facing this microenterprises is poor performance that is attributed by lack of adequate finance and limited access to credit, inadequate knowledge and skills, rapid technology changes, poor infrastructure and unfavourable regulatory environment. This has led to closer of some microenterprises due to multiple losses and others never grow to macro enterprise levels. Thus a further research is needed to gap the problem.

On the other hand the importance of loan structure helps microenterprises to maintain good record on its performance. However, Nasser et al., (2014) assessed the effect of loan repayment on performance of Microenterprise in Addis Ababa enterprises. Odongo (2014) evaluated the effect of loan lending period and Financial Performance of Small Medium Enterprises in Uganda and Nyumba et al., (2015) evaluated effect of loan interest rate on the performance of small and medium size enterprises in Lurambi Sub-County. These reviews indicated that repayment of loans by microenterprises has sabotage its management due to meagre profits and frequent losses made. This has derailed performance and growth of microenterprises.

None of the past reviewers has researched on loan structure and its performance of microenterprises in Eldoret Town. Based on these gaps, this study is motivated to investigate the effect of loan structure on the performance of microenterprises in Eldoret Town, Kenya.

Specific Objectives
1. To evaluate the effect of instalment payments on the performance of microenterprises in Kenya
2. To determine the effect of repayment period on the performance of microenterprises in Kenya
3. To find out the effect of loan interest on the performance of microenterprises in Kenya
4. To establish the effect of loan security on the performance of microenterprises in Kenya

Theoretical Framework
The Pecking Order Theory of Financing
The pecking order theory was postulated by Myers in 1984. The theory states that microenterprises prefer hierarchical financing decisions in borrowing and repaying debts. There is a strict ordering or hierarchy of sources of funds for firms. The assumption of the theory states that firms will prefer retained earnings to any other source of finance and then choose debt and lastly equity (Njama, 2013).

Theory suggests that a more flexible repayment schedule would benefit clients and potentially increase their repayment capacity, microfinance experts believe that the discipline imposed by regular repayment maintains high repayment rates in the absence of collateral. Although this feature is less usual than the previous mechanisms, it helps MFI to maintain high repayment rates (Arrendadoriz & Morduch, 2000; Morduch, 1999). In the MFI, the repayment starts almost immediately after disbursement and then occurs on a weekly or monthly basis. Critiques show that the pecking order theory of financing argues that adverse selection issues in raising funds from different sources overlook other considerations in the Trade-off model resulting in a hierarchy of funds (Mmbaya, 2013). The Trade-off theory assumes that there are benefits to leverage within a capital structure until the optimal level is reached (Waweru, 2014).

This theory is useful to the study as it supports the objective of loan instalments on performance of microenterprises. Microenterprises used internal sources of funds first to repay their loan and after exhausting such options, they will resort to using new equity finance (Njama, 2013). Firms have more information about the credit risk facing them than the providers of funds resulting in adverse selection (Kago, 2014). According to this theory, SMEs will prefer internal sources of funds followed by debt and lastly equity finance when internal and debt sources are exhausted. Loan repayment by the borrower is dependent on various aspects such as the interest rate, Age, level of education, level of income, and corporate membership.
Adverse Selection Theory of Financial Markets

The adverse selection theory of financial institutions originates from the work of Stiglitz and Weiss (1981). In his explanation interest charged by a credit institution are assumed to have a dual role of sorting potential borrowers (leading to adverse selection) and affecting the actions of borrowers (leading to incentive effect). Interest rates thus assumed to affect the nature of the transaction and do not necessarily clear the market. Both effects are seen as a result of the imperfect information inherent in credit markets.

Assumptions of adverse selection theory states that adverse selection occurs because lenders would like to identify the borrowers most likely to repay their loans since the financial institutions expect returns depending on the probability of repayment. In order to identify borrowers with high probability of repayment, banks are likely to use the interest rates that an individual is willing to pay to screen. However, borrowers willing to pay high interest rates may on average be worse risks; thus as the interest rate increases, the riskiness of those who borrow also increases, reducing the bank’s profitability.

Huberman and Repullo (2014) critique that higher interest rates induce microenterprises to undertake projects with lower probability of success but higher payoffs when they succeed (leading to the problem of moral hazard). Since the bank is not able to control all actions of borrowers due to imperfect and costly information, it will formulate the terms of the loan contract to induce borrowers to take actions in the interest of the bank and to attract low risk borrowers. The result is an equilibrium rate of interests at which the demand for credit exceeds the supply. Other terms of the contract, like the amount of the loan and the amount of collateral, will also affect the behaviour of borrowers and their distribution, as well as the return to banks.

Adverse selection theory is useful to the study because it supports the third objective on the effect of interest rates. Adverse selection arises because in the absence of perfect information about the borrower, an increase in interest rates encourages borrowers with the most risky projects, and hence least likely to repay, to borrow, while those with the least risky projects cease to borrow. Interest rates will thus play the allocative role of equating demand and supply for loanable funds, and will also affect the average quality of lenders’ loan portfolios. Lenders will fix the interest rates at a lower level and ration access to credit. Imperfect information is therefore important in explaining the existence of credit rationing for small and microenterprises. Moral hazard occurs basically because projects have identical mean returns but different degrees of risk, and lenders are unable to discern the borrowers’ actions.

Ex Ante Theory of Collateral

Ex Ante Theory of Collateral was postulated by Stiglitz and Weiss in 1981. The Ex Ante Theory of Collateral explains the gap between borrowers (Microenterprises) and lenders (Banks/MFIs) that can otherwise lead to an equilibrium characterized by adverse selection and loan rationing. The assumption of Ex ante theory is that they only hold for customers with short relationships with the lender, that is, borrowers that are relatively unknown to the lender. In this case, collateral allows financial institutions to sort observationally equivalent loan applicants through signalling.

Gavalas and Syriopoulos (2015) critique that Lenders offer a menu of contract terms such that applicants with higher-quality projects choose secured debt with lower risk premiums, while those with lower-quality projects self-select into unsecured debt with higher risk premiums. For instance, ex ante fixed seniority of lenders can serve as an instrument to strategically allocate bargaining power between lenders, thereby deterring costly conflicts ex post. Ex ante private information and suggests that collateral may allow lenders to sort observationally equivalent loan applicants through signalling. Specifically, lenders offer a menu of contract terms such that observationally equivalent applicants with higher-quality projects choose secured debt with lower risk premiums, while those with lower-quality projects self-select into unsecured debt with higher risk premiums (Berger et al., 2011).

According to Berger et al. (2010), the loan security (collateral) as arising from ex ante information gaps between borrowers and lenders lead to an equilibrium characterized by adverse selection and credit rationing. The study further acknowledges that in this case, collateral allows lenders to sort observationally equivalent loan applicants through signalling. Specifically, financial institutions offer a list of terms such that observationally equivalent applicants with higher-capital choose secured debt with lower risk premiums, while those with lower-capital operations self-select into unsecured debt with higher risk premiums which limit growth of microenterprises.

Conceptual Framework

Figure 2.1: Conceptual Framework

Empirical Review

The empirical review of literature shall look at the empirical evidence on the independent variable.

Instalment payments and Performance of Microenterprises

An instalment payment is the business loan in which the principal and interest are repaid in equal instalments at fixed intervals (usually every month). It is one of a series of regular payments that you make until you have paid all the money you owe (Kuada, 2019). On literature review Noah (2015), investigated the effect of loan instalments on the cash flows of SMEs in Kanduyi constituency in Bungoma County. The study findings revealed that frequency of loan repayment does not have a significant effect on the cash flows of SMEs. Majority 67.39% indicated that frequency of loan repayment does not affect SMEs cash flows. Only 32.61% agreed that frequency of loan repayment affects SMEs cash flows. The loan amount and
business sector does not have a significant effect on the cash flows of SMEs. The study, however, found out that age of business has a significant effect on the cash flows of SMEs. In conclusion, the study found out that SMEs could choose to repay the loans either on weekly basis or monthly. The frequency of loan repayment has no significant effect on the cash flows of SMEs.

Mogire (2016) analyzed the influence of loan repayment schedules on Growth of Small Business Enterprises in Kenyanya Sub-county–Kisii County, Kenya. The study used survey research design. The study found that loan repayment analysis from the rural enterprise records shows that its crystal clear that the outstanding loans balances advanced to MSEs keeps on growing on the subsequent years depicting a problem with the performance of these enterprises. The survey was more concerned with repayment of credit/loans in determining the performance of MSEs rather than looking at the profitability of these enterprises, savings, assets, market share, employment and stock levels. This study thus focuses on the effect of loan instalments on performance of microenterprises.

Noah (2015) further critique that weekly repayment of funds are sometimes raised through sale of productive assets, under stocking, or reduced consumption and this affects the growth of business. A monthly repayment schedule could assist MFI clients manage their cash flows better, repay their loans on time and have sufficient working capital. Weekly repayment schedule may limit the amount of loan a client can borrow, increases workload for the loan officers, and may lead to exit of lucrative clients. Client retention may be affected by the frequency of repayment because clients could leave the program to join another MFI offering monthly repayment schedule.

Nasser, Ahmed and Shewalem (2014) assessed the effect of loan repayment on performance of Microenterprise in Addis Ababa enterprises, particularly to Arada Sub-city. The study adopted cross-sectional research design. Findings show that a good repayment performance is an important measure for the success of micro enterprises. Hence, it is advisable to credit schemes initiatives to make more attention to investigate factors that affect loan repayment performance which enables the problem to reach millions of poor. According to the findings, educational level, supervision, available of other source of credit and monthly repayment period are found to be positively related to repaying loan in full in a repayment period of one year. Loan diversion and loan size has a negative relation. Hence, factors that enhance and hinder loan repayment performance should be considered by Arada Sub-city and Credit and Saving Office in designing a more effective loan repayment mechanism for its borrowers.

Kamath and Ramanathan (2015), argue that the need to raise funds for weekly repayment makes clients take informal sector loans. They argue that MFI benefits from these informal lenders because of their effective collection methods and therefore prefers are payment schedule that makes it more likely that a client will also take credit from money lenders to service the loan. Field and Pande (2008) found out that there is no significance effect of type of repayment schedule on delinquency or default. The study suggests that a more flexible schedule can significantly lower transaction costs without increasing client default. Field and Pande identified weekly collection of repayment installments as a key feature of MFI that is believed to reduce default risk in the absence of collateral and thus make lending to the poor viable. They also identified weekly collection as a key feature that increases MFI’s transaction costs, thereby limiting the set of loan sizes and client types that are profitable under weekly repayment schedule. Field and Pande reported that access to future loans is the main incentive for clients to avoid default.

Muhammad, Bambale, Ibrahim and Sulaiman, (2019) examined Loan Repayment and Performance of Small and Medium Enterprises in Kano Metropolitan. The study uses cross-sectional primary data, stratified sampling techniques, and finally employed chi-square test to test the association of the independent variables and loan repayment performance. A total of eleven explanatory variables were included in the chi-square. According to the chi-square test, group formation (screening), peer monitoring, loan size, loan term and supervision have significant association with loan repayment performance.

Dire (2018) studied the effect of loan instalments on performance of micro and small enterprises in Jimma town, Ethiopia. Study used survey research design as a methodology. The study found that there are different factors which influence MSEs for successful loan repayment either internal or external, among factors that confronting MSEs such as individual characteristics, loan characteristics and firm characteristics that impeding the successful loan repayment of MSEs in Jimma town, Ethiopia. Among this inconvenience loan payback period, Lack of financial skills and planning, lack of marketing skills, lack of performance monitoring was focuses of the study because majority of banks and financial intermediaries are providing loan based on the creditworthiness and performance of MSEs in loan repayment, however, it is necessary to know basic factor that impeding loan repayment of MSEs. This study recommends remedial actions to be taken in order to tackle the identified hindering factors.

Firafis (2015) evaluated the effect of loan repayments frequency and performance of Hirari micro-enterprises. The study employed descriptive statistics and logistic regression (binary logit) to analysis the data. The study revealed that loan size significantly influenced loan instalments and performance of microenterprises. In the same vein, Seyedmehrdad, Andrea, Giorgio, Emanuele and Paolo (2015) found that loan size has significant relationship with loan repayment and performance of Indian Institute for Mother and Child. Similarly, Tesfaye, Tesfatsion and Kiros (2014) also studied the determinants of loan repayments frequency and performance of SMEs in Ethiopia. The study employed binary logistic regression to analysis the data. The study revealed that loan size significantly influenced loan instalments on performance of SMEs. Al-Sharafat, Quaishtat and Majdalawi (2013) assessed the loan-instalments on performance of public agricultural credit agencies in Jordan. The result of this study further revealed that size of loan size, size of loans repaid number of borrowers and numbers of credit agency staff and borrower experience have positive effects on loan repayment.

**Repayment period and Performance of Microenterprises**

Repayment period is the time between the first payment on a loan and its maturity. For example, if one takes out a student loan with a payback period of 10 years, the full amount of the loan is
due 10 years after the first payment, which occurs on an agreed-upon date (Mogire, 2016). On literature review Odongo (2014) evaluated the effect of loan lending period and Financial Performance of Small Medium Enterprises in Uganda. The study adopted cross sectional research design. The findings showed that shorter term credits will prevail. This direct impact on SMEs was noted when attracting new funding; repayment period will possibly be shorter as the MFIs might be afraid that they are not able to pay their own loan because they are less sure that they will get their outstanding credits back. They concluded that some MFIs require borrowers to make compulsory deposits before they can receive a loan; borrowers typically must maintain these deposits during the life of the loan. The costs of money borrowers receive on these deposits are well below the rates borrowers pay on their loans. The effect of such deposit requirements is to reduce the net additional cash borrowers realize from their loans and, thus, to increase the effective cost of the loan to them. About one-third of the sustainable MFIs reporting to microfinance information exchange required such savings deposits, and on average these MFIs are smaller than the ones that do not use compulsory savings.

Wakaba (2014) determined the effect of repayment period on the financial performance of small and medium enterprises in Kiambu County. The study used descriptive survey research design. The study findings indicated that repayment period, costs of money and loan size are good predictors of the SMEs financial performance because the business is able to look at the sales turnover, payment ability, good returns in assets and the market share in the market, increase in profits and customer base maintained for a company to break even. Further, the study agrees that the ability of the SMEs to meet all their financial obligations, asset accumulation and number of years in business is the good predictor of financial performance.

Oduru-Ofori, Anoye and Mathias (2014) conducted a study on repayment period and performance of Micro and Small Enterprises (MSEs) in the Ashaiman municipality of Ghana. The study used descriptive survey research design. The study found that timely repayments of loans were not made from incomes gained from business operations but through further borrowing from private money lenders, therefore few of these MSEs ever develop into mega business concerns and a large number of them either remain small or simply fizzle out. It can be noted that credit to MSEs have been found to cause trauma and even self-pity and unfulfillment perpetuating a vicious cycle of financial problems to majority of borrowers.

Odongo (2014) in a study on the effects of repayment period and financial performance of small medium enterprises in Uganda found that, lending is predominantly short term and low to SMES due to poor credit discipline, contractual enforcement problems, and scarcity of projects and lack of collateral. Despite SMEs’ perceptions of excessively high interest rates, the cost of finance is found to compare favorably with and generally the issue relates to the amount (monetary value) of the installment as opposed to the cost of credit. When installments are high (due to inadequate loan maturities or inadequate product structure) the cost of money is perceived to be high. Low installment amounts represent a much higher cost of money, are perceived as being less expensive. The maturity of loans is also a serious issue, as Uganda seems to have the shortest average loan maturity (12 months) among comparable countries such as Kenya, Brazil, China and India (CGAP report, 2009). The MFIs short term loans are not conducive for rural farmers who rely on climatic conditions to pay the loans and long term loans are not available to cater for animal production which are costly and risky. The financial institutions credit terms are recognized to meet SMEs working capital not for asset accumulation in the long run and limited access to loans of not more than 12 months.

Chin and Nor (2016) determined whether does the micro financing term dictate the performance of micro enterprise. The study findings show that loan tenure has also been found to be critical for access to enterprise performance. Loan repayment period negatively influences access to credit as it has a major bearing on the total amount to be repaid. Specifically, making a long-term financing or loan will increase the rate of interest to be paid in the long run. When enterprises perceive repayment period as inflexible, they will have no chance to apply for another financing and this will affect the performance of enterprise to obtain back their investment. Nkundabanyanga, Kasozi, Nalukenge and Tauringana (2014) also found that the short term repayment period does not meet the enterprise’s long term financing and as a result, they will take any amount of loan that the financial institutions are willing to offer them. From the discussion above, it can be concluded that tenure has an insignificant effect towards the performance of micro enterprise in terms of return on Asset. This conclusion is drawn from the fact that tenure has its own antecedents such as individual’s capacity and financial institution’s ability to collect and ensure repayments.

### Loan Interest and Performance of Microenterprises

Loan interest rate is the amount a lender charges for the use of assets expressed as a percentage of the principal. The interest rate is typically noted on an annual basis known as the annual percentage rate (APR) (Charman, 2017). Shaikh (2017), examined the effect of loan interest on poverty alleviation through financing microenterprises with equity finance. The study used descriptive survey research design. The study found that high rate of interest on loans is effectively a burden on the incomes of the poor and microenterprises. Given the low capital intensity of investment made through lending institutions and the resultant low profit margins, high interest rates dampen the possibility of any significant savings on the part of the poor borrower who largely borrows to meet consumption related to household requirements. Therefore the fast economic growth anticipated after use of credit is not achieved instead a marginal economic growth is witnessed. This perhaps explains why there is continues increase in unemployment and poverty is on the increase despite efforts being made to improve the performance of MSEs which have been widely accepted a being engines of national economic development.

Nyumba, Muganda, Musiega and Masinde (2015) evaluated effect of loan interest rate on the performance of small and medium size enterprises in Lurambi Sub-County, Kenya. The study used descriptive survey research design. The study was based on the bank lending channel theory. The data for the study was collected by use of questionnaire. Cronbach’s Alpha of coefficient test was used to determine the reliability while test-retest and data triangulation technique was used to determine the validity of the instruments. The study used the correlation ρ (beta,
to test the research question. The test criteria was set such that there is either a positive or negative effect if the value of beta, β2 ≠ 0. The study evaluated the mean of loan interest and the mean of performance of small and medium size enterprises in Lurambi sub-County. From the results, the correlation of the mean of interest rate and mean of performance had a beta term β = -0.289, P=0.01. This implies that the value of beta is negative and significant. Basing on this value, it therefore implies that there exists a statistically significant negative effect of interest rate on the performance of SME’s.

Nyumba et al., (2015) also noted that SMEs may still face challenges in accessing formal finance in the form of bank loans, guarantees, venture capital and leasing. For instance, although SMEs are by far the largest group of customers of commercial banks in any economy, loans extended to SMEs are often limited to very short periods, thereby ruling out financing of any sizable investments. Moreover, due to high-perceived risks in SME loans, access to competitive interest rates may also limit.

Msangula (2015) examined the effect of loan interest rates to SMS’ Performance and Growth in Tanga City. The study used descriptive survey research design. Data for the study was collected from 83 respondents using structured questionnaire. The result of the study has revealed loan interest rates to have effect on SMEs performance and growth; which is presented by majority 68.7 per cent who had yes response. This particular response is further supported by 44.6 per cent who reported to experience slow growth of business capital and 39.8 per cent who responded to have continued operating on less profit respectively. However, a slow growth of business capital is explained as the decision of loan seeker opting to take small loan amount from the fear of paying more money charged on interest rate. Nevertheless, price fluctuation, business seasonality and economic hardship were emerged other factors challenged their business performance.

Msangula (2015) also found that loan’s interest rates charged by lenders (MFIs) are not well-suited with the performance of the SMEs and that most of them charge high interest rates compared to larger firms which usually comply with higher disclosure requirements to a greater extent. Interest rates yielded by any investment take into account the following parameters: the risk-free cost of capital, inflationary expectations, the level of risk in the investment and the costs of the transaction. Indeed, interest rates are thus made to keep inflation within a target range for the health of economic activities to safeguard economic momentum. Wang (2016) examined the biggest obstacles to growth of SMEs in developing countries. The study adopted cross-sectional study design. The study noted that interest rate is seen to influence the significance contribution of SMEs to development. The likely indication for SMEs significant contribution is observed in the economy in terms of output of goods and services, and creation of jobs at relatively low capital cost. It is a vehicle for the reduction of income disparities among skilled and none skilled individuals and is basis for the future industrial expansion; improve forward and backward linkages between economically, socially and geographically diverse sectors of the economy. SMEs provide opportunities for developing and adapting appropriate technological approaches and offer an excellent breeding ground for entrepreneurial and managerial talent.

Gichuki, Njeru and Tirimba (2014) studied on the challenges facing micro and small enterprises in accessing credit facilities in Kangemi Harambee Market in Nairobi City County, Kenya. The study used cross-sectional research design. The study found that credit for small enterprises forces them to rely on high cost short term finance. There are various financial challenges that face small enterprises. They include the high cost of credit, high bank charges and fees. The scenario witnessed in Kenya particularly during the climaxing period of the year 2008 testifies the need for credit among the common and low earning entrepreneurs. Numerous money lenders in the name of Pyramid schemes came up, promising hope among the ‘little investors,’ which they can make it to the financial freedom through soft borrowing. The rationale behind turning to these schemes among a good number of entrepreneurs is mainly to seek alternatives and soft credit with low interest rates while making profits. Financial constraint remains a major challenge facing SMEs in Kenya. Mazumder, Dastidar and Bhandari (2017) access effect of loan interest credit and growth of micro entrepreneurship. The study utilized descriptive survey research design. The study found that high interest rates as an impediment to access to loans from Micro finance institutions (MFIs) by micro entrepreneurs. Micro entrepreneurs who secure funds from such institutions spend the bulk of their returns on investment in paying the cost of capital, thus leaving them with none or little savings for reinvestment. As a result, majority of micro enterprises fail to grow into Small and eventually Medium enterprises. Therefore, to bring the youth on board, the Kenyan government with the support of development partners in 2006 established a youth enterprise development fund that is channelled to Micro finance Institutions and other financial intermediaries for onward lending to the youth without collateral. Such a fund attracts a greatly reduced cost of capital which stands at 8% per annum as a strategy to make the fund affordable to the youth who in many cases do not have collateral and therefore ideal for start-ups.

Loan Security and Performance of Microenterprises

Loan security is loan secured by the pledge of any marketable asset as collateral. Not to be confused with 'securities loan' which is a loan collateralized by marketable securities (Msangula, 2015). Campello and Larrain (2016) determined the effect of loan security on the performance of microenterprises. The study adopted descriptive survey research design. The study found that firms with tangible collateral seem to be doing well in terms of access to credit than those that don’t. There is therefore a positive but insignificant relationship between collateral and performance of SMEs generally. Collaterals are used as a mechanism to reduce equilibrium credit rationing and other problems that arise due to asymmetric information between borrowers and lenders. Besides, increases in a firm’s collateral value relax the credit constraint faced by the firm, enabling the firm to borrow more. Loan Security is regarded as a secondary source of repayment, and therefore is only used in assessing the amount of loan loss provision required for non-performing loans. Where securities are obtained, they should be perfected in all respects, namely; duly charged, registered and adequately insured.

Rahman, Belas, Kliestik and Tyll (2017) determined the effect loan security on performance of microenterprises from the Visegrad countries (V4, cultural and political alliance of four Central European countries - the Czech Republic, Hungary, ...
Poland and Slovakia). The study adopted survey descriptive research design. The study found that the greater the amount of loan security possessed by an SME, the lower is likely to be the extent of the financial limitation. In more general terms it can be postulated that the greater the financial depth or development of a financial system, the greater was the availability of loans to firms, including SMEs, and, therefore, the lower was the extent of any financial gap. Access to collateral can be postulated to be positively related to firm performance, as with business transparency, preparation of business plans, the skill level of the entrepreneur and credit rating of the business.

Thuku (2017) examined the factors affecting access to credit by small and medium enterprises in Kenya. The study used cross sectional research design. The study found that lending decisions of financial institutions are traditionally based on the availability of collateral security, a sound business plan with sufficient cash flow, and personal guarantors for loans. Full collateral, using land and buildings are often required by banks to cover losses in case of default. The effect of collateral security on performance of small firms is negative as it is a major deterrence to access to credit.

Demirguc-Kunt, Klapper and Singer (2017) evaluated effect of loan accessibility in the inclusion and inclusive growth of microenterprises. The study used a survey research design. The findings showed that lending conditions may depend on the distance between the borrower and the lender and the distance between the borrower and the competing bank. This implies that if there are so many banks within convenient distance to the small businesses, the proprietors will have alternatives to shop around and will have the benefit of learning the requirements of accessing those loans. Further a behaviour that is predominantly found amongst small businesses, where a lender connected to the community can easily know whether the account behaviour of a business is due to lack of financial knowledge on the part of the lender or lack of viability in the business.

Kamunge, Njeru and Tirimba (2014) establish the factors affecting the performance of small and micro enterprises (SMEs) traders at Limuru town market in Kiambu County, Kenya. The study employed a descriptive research design to achieve the objectives. The target population under study was the 965 licensed SMEs by Limuru sub-county operating in Limuru Market in 2014. The study used a questionnaire to collect the required data from a sample of 274 SMEs. The data collected was coded, quantified and analyzed quantitatively and qualitatively. Quantitative data was analyzed by the use of statistical package for social sciences (SPSS). The study concluded that access to finance and availability of management experience are the key socio-economic factors affecting the performance of businesses in Limuru Town Market. The other key factors that were found to affect businesses in Limuru Town Market positively are: access to business information, access to infrastructure and government policy and regulations. The study recommended that the government should start offering basic business and financial management skills as this enabled entrepreneurs to make informed investment decisions as well as enhance their entrepreneurial skills that enable them to recognize and exploit the available business opportunities.

Omwono, Paul and Omwono (2018) examined the effect of loan security on the financial performance of micro, small and medium enterprises. The study adopted cross sectional research design. The study found that a shortage of collateral leads to limited financing which is one of the major barriers to rapid development of the small and medium enterprises. The recent global financial crisis created a tough environment for SMEs, with a reduction in demand for goods and services and a contraction in credit by banks and other financial institutions. SMEs by number, dominate the world business stage. It is worthwhile noting that, SMEs tend to be more labour intensive and at a macro level, therefore, provide a substantial contribution to employment. However, they are strongly hampered in accessing the capital that they require to grow and expand, with nearly half of SMEs in developing countries rating access to finance as a major impediment.

Pencea and Oehler-Sincai (2015), investigated the effect of loan security on performance of Investment-Led Development in China. The study adopted descriptive survey research design. The study found that the provision of credit and other services to small and medium enterprises has traditionally been challenging since there is limited loan security to allow them secure desired loans. The growth of the microenterprises was slow since most of them lack enough credit for expansion. On the one hand, the challenge may be related to a lack or non-existence of financial history and the inability to provide required collateral among small and medium enterprises. This was in agreement with Madole (2013) who did a similar study in Tanzania and found out that there was a positive and significant effect of access to loan on sales volume, profitability and number of employees of firms. This study focuses on collateral and lack of financial credit history as the major hindrances to credit access. The study did not take into account that access to credit can be influenced by credit history, age and size of the firm, education levels of firm owners and managers, sales turnover among other factors such as the time the lender takes to process the credit facility, or the repayment period.

Hyder and Lussier (2016), examined why the businesses succeed or fail: a Study on Small Businesses in Pakistan. The study found that financial crisis and subsequent widespread economic downturn had a huge impact on the accessibility of finance to SMEs. SMEs in many developing countries before the crisis had been strongly restricted in accessing the capital that they needed to grow and expand. Performance of firms is positively related to access of finances. However, banks do not provide SMEs with adequate capital in many of these countries because they lack collaterals. In fact, only 20% of African SMEs have a line of credit from a financial institution. The financial crisis has further increased the financing gap for SMEs in developing countries. Rahman, Belas, Kliestik and Tyll (2017) evaluated the effect of collateral requirements for SME growth from the Visegrad Countries. The research adopted survey research design. The examination found out that most of the requirements as collateral for loan application could not be afforded by most SMEs, hence opting for cheaper sources of capital hence the low adoption of the loan services by businesses. Financial institutions loans led to the improvement in performance among the beneficiary SMEs, as well as profitability and the high number of entrepreneurs starting up new ventures. There exists negative relationship between ROA and collateral of FI lending. This contradicts Nyabicha (2015) who asserts that collateral requirements

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positively affect the performance of businesses in Nairobi. Apart from the mixed results found by the scholars, the study of collateral security and their influence has received less attention by scholars. Collaterals are increasingly becoming important to financial institutions as a secondary source of repayment and cannot be overlooked as lack of it may deny SMEs the much sophisticated capital required for business growth.

**RESEARCH METHODOLOGY**

A descriptive study was adopted for this study. The target population was 2508 registered enterprises according to Uasin Gishu County government records (Company Registrar, 2019). The listed microenterprises include Agrovet, Banking Agencies, Boutiques, Chemist, Electronic Shops, General Shops, Groceries, Guest Houses, Hardware, Hotels, Membership Clubs, Mobile and Phone Accessory Shops, SACCOS, Salono and Barber Shops and Service Firms. This study used stratified random sampling technique to collect data from the respondents; because stratification ensured homogeneity within microenterprises and heterogeneity across microenterprises. This study adopted structured closed ended type of questionnaires; the questionnaires were administered by the researcher to the respondents. The structured questions were in the form of a five point Likert scale, whereby respondents was required to indicate their response on a scale of 1 to 5. The data collected was analyzed using the statistical package for social sciences (SPSS V 20). Quantitative data was analyzed using both descriptive and inferential statistics.

**Research Findings and Discussion**

**Instalment Payments and Performance of Microenterprises**

The first objective was to evaluate the effect of instalment payments on the performance of microenterprises in Kenya. The study focused on the effect of weekly, monthly, twice in a year and annual payments. The study was interested with the opinions of the respondents on the extent to which such constructs effects the performance of microenterprises in Kenya. The study research asked respondents to give their opinion on the statement that weekly payments affects financial performance of microenterprise. Majority of the respondents 82.4% agreed and 16.3% disagreed with the statement. Respondents also respondents to monthly payment and majority 86.3% agreed that monthly instalment payment affect performance of microenterprises and 9.1% disagreed with similar statement. Monthly instalment payments are the most common type of loan repayments to most entrepreneurs as the way of paying back the loan borrowed. Instalment repayment greatly dependent on loan size which is used to determine spread of repayment. Seyedmehrdad, Andrea, Giorgio, Emanuele and Paolo (2015) found that loan size has significant relationship with loan repayment and performance of Indian Institute for Mother and Child.

The study respondents’ view on payment of instalment twice a year revealed that 80.5% of the respondents agreed and 12.4% disagreed with the statement that microenterprises are rarely allowed to make instalment payments twice a year. The study respondents’ opinion on annual payment revealed that majority of the respondents 90.9% agreed that microenterprises rarely allow customers make annual payment instalment and 5.3% disagreed with the statement. The study results showed that majority of the respondents agreed that instalment repayments range from the commonly monthly, after a fortnight, others pay weekly, another group repay their loan after three months, others repay after six months and very few repay their loan annually. The performance of the microenterprise can greatly depend on the capital and delinquent cash. When more money is paid out to cater for loan weekly, little is saved for the purpose of improving performance of the business. Microenterprises that repay their instalments monthly, in three months, six months or annually thrive better than those that repay their loan weekly or in a fortnight.

The findings are in agreement with Noah (2015) who critique that weekly repayment of funds are sometimes raised through sale of productive assets, under stocking, or reduced consumption and this affects the growth of business. A monthly repayment schedule could assist MFI clients manage their cash flows better, repay their loans on time and have sufficient working capital. Weekly repayment schedule may limit the amount of loan a client can borrow, increases workload for the loan officers, and may lead to exit of lucrative clients. Client retention may be affected by the frequency of repayment because clients could leave the program to join another MFI offering monthly repayment schedule.

**Repayment Period and Performance of Microenterprises**

The second objective was to determine the effect of repayment period on the performance of microenterprises in Kenya. The study focused on the effect monthly repayment period, annual repayment period and more than 10 years of loan repayment period. The study was interested with the opinions of the respondents on the extent to which such constructs influences performance of microenterprises in Eldoret town. Respondents were asked to give their view on the statement that the repayment period of loan is monthly. The findings showed that majority of the respondents 86.3% agreed that repayment period of loan is monthly. Respondents who disagreed were 11.1%. The research also asked respondents to give their opinion on the statement that microenterprise loan repayment period is annual. The study findings revealed that 77.9% agreed with the statement and 7.9% disagreed. Respondents view on the statement that microenterprises are given a loan repayment period of between 2-5 years reveal that 82.4% of the respondents agreed and 9.1% disagreed with the statement. Respondents view on the statement that microenterprises are given a loan repayment period of between 6-10 years reveal that 84.3% of the respondents agreed and 5.9% disagreed with the statement.

Respondents view on the statement that microenterprises are given a loan repayment period of more than 10 years reveal that 92.2% of the respondents agreed and 5.2% disagreed with the statement. Microenterprises that has a wider production range and optimizes large amount of loans are given enough time to clear up their loans running up to 10 years. Majority of the microenterprises that produce small range of products and take medium and small sizes of loan are given short period of repayment. Repayment period of the most microenterprises is monthly and other microenterprises make their repayments in three months, six months or 9 months. Decision on repayment period depends on the amount of loan issued and the purpose of the loan. Repayment period with adjusted or extended terms help microenterprises do better because they can generate enough...
profit to assist in offsetting the expenses and debts owed. Performance of microenterprise is greatly determined by loan repayment period. 

Chin and Nor (2016) findings supported that loan tenure has been found to be critical for access to enterprise performance. Loan repayment period negatively influences access to credit as it has a major bearing on the total amount to be repaid. Specifically, making a long-term financing or loan will increase the rate of interest to be paid in the long run. When enterprises perceive repayment period as inflexible, they will have no chance to apply for another financing and this will affect the performance of enterprise to obtain back their investment. Wakaba (2014) who indicated that repayment period, costs of money and loan size are good predictors of the SMEs financial performance because the business is able to look at the sales turnover, payment ability, good returns in assets and the market share in the market, increase in profits and customer base maintained for a company to break even.

### Loan Interest and Performance of Microenterprises

The third objective was to find out the effect of loan interest on the performance of microenterprises in in Kenya. The study focused on the effect of low interest rate, high interest rate and moderate interest rate. The study was interested with the opinions of the respondents on the extent to which such constructs influences performance of microenterprises in Eldoret town. Respondents gave their opinion on the statement that the loan interest rate is low and therefore affordable to repay. The study findings revealed that majority of the respondents 89.6% agreed that the loan interest rate is low and therefore affordable to repay and 9.1% of the respondents disagreed with the statement. Respondents gave their view on the statement that the interest rate is moderate and therefore manageable for microenterprises. 93.5% of the respondents agreed that the interest rate is moderate and therefore manageable for microenterprises. 3.9% of the respondents disagreed. Microenterprises supported the fact that interest rates from other MFIs are moderated and can be managed since they favour growth of the small business.

Respondents gave their opinion in the statement that the loan interest rate is high and this has negatively affected performance of the microenterprises. From the findings, majorities of the respondents 93.5% agreed that the interest rate is high and this has negatively affected performance of the microenterprises. The findings are supported by Mazumder (2017) who found that high interest rates as an impediment to access to loans from Micro finance institutions (MFIs) by micro entrepreneurs. Micro entrepreneurs who secure funds from such institutions spend the bulk of their returns on investment in paying the cost of capital, thus leaving them with none or little savings for reinvestment. As a result, majority of micro enterprises fail to grow into Small and eventually Medium enterprises.

Respondents were further asked to respond to the statement that performance of microenterprises is directly affected by the loan interest rate limits. Findings showed that 85.0% of the respondents agreed that performance of microenterprises is directly affected by the loan interest rate limits. Respondents who disagreed with the statement were 0.7%. The findings are in line with Nyumba et al., (2015) who found that loans extended to SMEs are often limited to very short periods, thereby ruling out financing of any sizable investments. Moreover, due to high-perceived risks in SME loans, access to competitive interest rates may also limit

Also respondents were asked to give their opinion on the statement that interest rates require moderation to ensure improvement on performance of microenterprises. Findings showed that 80.4% of the respondents agreed that interest rates require moderation to ensure improvement on performance of microenterprises. Respondents who disagreed with the statement were 4.6%. Moderated loan interest rates enables microenterprises access large amount of money needed for business extension and expansion. Loan interest rates determine accessibility of loans and performance of microenterprise.

The study results has revealed that majority of the respondent agreed that the consequences of high interest rates weaken the performance of microenterprises because more percentage of generated income (profits) is used to pay the accrued loans without consideration of expansion of the business. High interest rates may sink the enterprise because operation costs are not paid on time and also assets can be sold to cater for the loans. Also interest rate limits depending on the amount of loans and the duration of repayment discriminates micro-entrepreneurs. Microenterprises that take up small loans end up paying more on the interest rates compared to Microenterprises that takes up large amount of loans. Microenterprises cannot perform well with such discrimination and unstandardized interest rates.

### Loan Security and Performance of Microenterprises

The fourth objective was to establish the effect of loan security on the performance of microenterprises in Kenya. The study focused on the sales volume, profitability and number employees. The study was interested with the opinions of the respondents on the extent to which such constructs influences performance of microenterprises in Eldoret town. Respondents were asked to give their views on the statement that flexible loan security terms have positively affected performance of microenterprises. Majority of the respondents 89.6% agreed that flexible loan security terms have positively affected performance of microenterprises. Respondents who disagreed were 9.1%. Pencea and Oehler-Sincai (2015) concurred that provision of credit and other services to small and medium enterprises has traditionally been challenging since there is limited loan security to allow them secure desired loans. The growth of the microenterprises was slow since most of them lack enough credit for expansion.

Respondents were asked to give their views on the statement that microenterprise performance is greatly hampered by limited access of credit. Majority of the respondents 93.5% agreed that microenterprise performance is greatly hampered by limited access of credit. Respondents who disagreed were 3.9%. Campello and Larrain (2016) concurred with the findings that loan security is regarded as a secondary source of repayment, and therefore is only used in assessing the amount of loan loss provision required for non-performing loans.

Respondents were asked to give their views on the statement that collateral value of microenterprises creates enabling environment for the firm to borrow more. Majority of the respondents 92.9% admitted that collateral value of microenterprises creates enabling environment for the firm to borrow more. Respondents who disagreed were 3.3%. The study findings were supported by Campello and Larrain (2016) who found that collaterals are used...
as a mechanism to reduce equilibrium credit rationing and other problems that arise due to asymmetric information between borrowers and lenders. Besides, increases in a firm’s collateral value relieves the credit constraint faced by the firm, enabling the firm to borrow more.

Respondents were asked to give their views on the statement that the amount of loan security possessed by microenterprises determines success and profitability gained. 85.0% of the respondents agreed that the amount of loan security possessed by microenterprises determines success and profitability gained. Respondents who disagreed were 0.7%. Rahman et al., (2017) concurred that the access to collateral can be postulated to be directly related to firm performance, as with business transparency, preparation of business plans, and the skill level of the entrepreneur and credit rating of the business.

Respondents were asked to give their views on the statement that the loan security limits performance of microenterprises. Majority of the respondents 80.4% admitted that the loan security limits performance of microenterprises. Respondents who disagreed views that microenterprises are positively related to access of finances. However, banks do not provide microenterprises with adequate capital in many of these countries because they lack collaterals. In fact, only 20% of African microenterprises have a line of credit from a financial institution. The financial crisis has further increased the financing gap for microenterprises in developing countries.

Majority of the respondents agreed that microenterprise performance is greatly limited by lack of enough access to credit. Creditors need loan security before issuing out loans and the challenge to microenterprises is that they lack collateral. Majority of them use business assets as the collateral to which if the loan repayment fails they have to sell the assets to offset the loans borrowed. Loan securities need to be adjusted since the collateral value of the microenterprises creates enabling environment for the firm to borrow more. And finally the amount of loan security possessed by microenterprises determines the success and profitability gained.

Performance of microenterprises

Responses on performance of microenterprises institutions in Eldoret Town, Kenya were also analysed. The study focused on the market share, product quality, service delivery and sales growth rate. The study was interested in the opinions of the respondents on the extent to which such constructs influences performance of microenterprises in Eldoret town. The research study asked respondents to respond on the statement that instalment payments are good and improve performance of microenterprises. The study findings revealed that majority of the respondents 92.9% agreed that the instalment payments are good and improve performance of microenterprises. Respondents who disagreed were 6.5%. The study respondents were asked to give their views on the statement that performance of microenterprises need adjustable repayment period that can allow negotiations to sort bending loans. The study findings revealed that majority of the respondents 93.5% agreed that performance of microenterprises need adjustable repayment period that can allow negotiations to sort bending loans. Respondents who disagreed with the statement were 5.2%.

Respondents also reacted to the statement that high interest rates reduce loan borrowing chances that directly affect performance of microenterprises. The study findings revealed that majority of the respondents 93.5% agreed that high interest rates reduce loan borrowing chances that directly affect performance of microenterprises. Respondents who disagreed were 5.3%. In addition respondents gave their views on the statement that loan security determines the amount of loan borrowed which in the long run affects performance of microenterprise. The study findings showed that majority of the respondents 90.9% agreed with the statement loan security determines the amount of loan borrowed which in the long run affects performance of microenterprise.

Performance of microenterprise depends on loan structure existing. A flexible loan structures makes enterprises effective and successful for instance adjusted instalment payments are good and enables the business to improve its performance. High interest rates reduce loan borrowing chances that directly affect performance of microenterprises specifically the economic microenterprises. And finally Loan security determines the amount of loan borrowed which in the long run affects performance of microenterprise.

Inferential Analysis

Inferential analysis was conducted in order to determine the existence of relationships between the study variables (the dependent and the independent variables). This study research conducted an inferential analysis using Pearson’s product moment correlation. Correlation is a statistical technique that shows how strongly pairs of variables are related. The correlation coefficient ranges from -1.000 to +1.000. The correlation coefficient value of -1.000 indicates a perfect negative correlation, correlation coefficient value of +1.000 indicates a perfect positive correlation and a correlation coefficient value of 0.000 implies that there is no relationship between the study variables (Orodho, 2013).

Overall Correlation Analysis Results

<table>
<thead>
<tr>
<th></th>
<th>Installment payments</th>
<th>Repayment period</th>
<th>Loan interest</th>
<th>Loan security</th>
<th>Performance of microenterprises</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installment payments</td>
<td>Pearson n</td>
<td>Sig.</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Repayment period</td>
<td>Pearson n</td>
<td>Sig.</td>
<td>.584**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Loan interest</td>
<td>Pearson n</td>
<td>Sig.</td>
<td>.450**</td>
<td>.587**</td>
<td>1</td>
</tr>
<tr>
<td>Loan security</td>
<td>Pearson n</td>
<td>Sig.</td>
<td>.631**</td>
<td>.360**</td>
<td>.589**</td>
</tr>
</tbody>
</table>

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The influence of instalment payments on performance of microenterprises was analysed and the findings were as shown in table above. The study results indicated that the instalment payments have a positive and statistically significant influence on performance of microenterprises with \( r=0.689, p<0.05 \). This implies that instalment payments influence performance of microenterprises.

**Loan interest and Performance of microenterprises**
The influence of Loan interest on performance of microenterprises was analysed and the results were shown in table above. Results revealed that loan interest had positive and statistically significant influence on performance of microenterprises with \( r=0.645, p<0.05 \). This implied that customer requirement to qualify for loan award influence performance of microenterprises of the borrowed loan among microenterprise institutions

**Loan security and Performance of microenterprises**
The influence of Loan security on performance of microenterprises in Eldoret town was analysed and the findings shown in table above. The study results indicated that loan security had positive and statistically significant effect on performance of microenterprises with \( r=0.610, p<0.05 \). This implied that loan security state influence performance of microenterprises. The findings are supported by Thuku (2017) who stated that full collateral, using land and buildings are often required by banks to cover losses in case of default. The effect of collateral security on performance of small firms is negative as it is a major detriment to access to credit.

**Multiple Regression Analysis**
The table below show results of model summary. Multiple linear regression analysis was used to determine the combined linear relationship between the dependent variable and the independent variables.

**Multiple Regression Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.795*</td>
<td>.632</td>
<td>.627</td>
<td>.34690</td>
</tr>
</tbody>
</table>

| a. Predictors: (Constant), Instalment period, Repayment period, Loan interest, Loan security |
| b. Dependent Variable: Performance of microenterprises |

The results in table above indicated that there is a positive and statistical significant influence of loan structure on performance of microenterprises as indicated by \( R^2=0.632 \). This implies that 63.2% variation in performance of microenterprises is accounted by loan structure (Instalment period, Repayment period, Loan interest, Loan security) in the study whereas 36.8% of the performance of microenterprises is accounted by other factors that were not covered in the study.

**Assessing the Fit of the Model Summary**
The analysis of variance (ANOVA) was used to determine if the multiple regression model was fit for the data. The results were as shown in the ANOVA table below;

**ANOVA Test Results**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>129.699</td>
<td>1</td>
<td>15.608</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>36.343</td>
<td>302</td>
<td>.120</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>98.775</td>
<td>306</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results indicates that the influence of independent variables on the dependent variable was statistically significant \( F=129.699; p<0.05 \). This implies that the multiple regression model was fit for the data and thus instalment period, repayment period, loan interest and loan security influence performance of microenterprises success.

**Regression coefficients**
The ANOVA table shows the regression analysis results. T-test of statistical significance of each regression coefficient was conducted in order to determine the beta \( (\beta) \) value which shows how strongly each independent variable influences the dependent variable.

**Regression Analysis**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \beta )</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>1.019</td>
<td>.155</td>
<td>6.561</td>
<td>.000</td>
</tr>
<tr>
<td>Instalment period</td>
<td>.228</td>
<td>.038</td>
<td>.314</td>
<td>5.996</td>
</tr>
<tr>
<td>Repayment period</td>
<td>.201</td>
<td>.036</td>
<td>.282</td>
<td>5.661</td>
</tr>
<tr>
<td>Loan interest</td>
<td>.137</td>
<td>.038</td>
<td>.180</td>
<td>3.564</td>
</tr>
<tr>
<td>Loan security</td>
<td>.196</td>
<td>.050</td>
<td>.205</td>
<td>3.937</td>
</tr>
</tbody>
</table>

The study findings in the above table shows the regression coefficients results whereby instalment period had a positive and statistical significant influence on performance of microenterprises \( (\beta=0.228, p<0.05) \), repayment period had a positive and statistical significant influence on performance of microenterprises \( (\beta=0.201, p<0.05) \), loan interest had a positive and statistical significant influence on performance of microenterprises \( (\beta=0.137, p<0.05) \) and Loan security a positive and statistical significant influence on performance of microenterprises \( (\beta=0.196, p<0.05) \). The multiple regression equation for loan structure was as shown below:
This implied that the performance of microenterprise was constant at 1.019 units given that all the key variables unchanged. The coefficient 0.228 indicates that an improvement or change on instalment period by one unit increases performance of microenterprises by 0.228 units, the coefficient 0.201 indicates that an improvement or change on repayment period by one unit increases performance of microenterprises by 0.201 units, a coefficient 0.137 indicates that an improvement of loan interest by one unit increases performance of microenterprises by 0.137 units and a coefficients 0.196 indicates that improvement of loan security by one unit causes an increase on performance of microenterprises by 0.196 units.

**CONCLUSIONS AND RECOMMENDATIONS**

**Conclusion of Findings**

From the findings the study concluded that instalment payments influence performance of microenterprises and the microenterprises that repay their instalments monthly, in three months, six months or annually thrive better than those that repay their loan weekly or in a fortnight. Monthly instalment payment is the most common type of loan repayments to most entrepreneurs. Instalment repayment greatly dependent on loan size which is used to determine spread of repayment. Also repayment period influence performance of microenterprises and the repayment period with adjusted or extended terms help microenterprises do better because they can generate enough profit to assist in offsetting the expenses and debts owed. Microenterprises that has a wider production range and optimizes large amount of loans are given enough time to clear up their loans running up to 10 years. Loan interest rates influence performance of microenterprises and microenterprises that take up small loans end up paying more on the interest rates compared to microenterprises that takes up large amount of loans. Microenterprises cannot perform well with such discrimination and unstandardized interest rates. Loan security influences performance of microenterprises in that it is greatly limited by lack of enough access to credit. Creditors need loan security before issuing out loans and the challenge to microenterprises is that they lack collateral and finally majority of microenterprises use business assets as the collateral to which if the loan repayment fails they have to sell the assets to offset the loans borrowed.

**Recommendations**

The study provides the following important recommendations for policy and practice

The study recommends to microfinance institutions who lend money to microenterprises to consider reviewing instalment payment extended to three months from the usual one month. Also the microenterprise institution managers to further seek more training on proper management of loan and successful investment on profit generating business ideas.

The study also recommends to MFIs managers to adopt a flexible repayment period so that they can allow microenterprises to grow and be able to pay their loans without selling their assets to repay the loans. The repayment period of loan should be adjusted to up to 5 or 10 years depending on the potential and capital strength of the microenterprise. And also litigation procedures for making debt collections should not be harsh to the customers.

The study also recommends to microfinance managers to lower their interest rates which in the long run will enable microenterprise managers repay the loan without much straining or selling of assets to repay the loan.

Finally this research recommends to the microfinance managers to establish flexible requirements on collaterals that cannot lock out microenterprises from accessing the loans or credit needed to expand their business and improve on the performance.

**REFERENCES**


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Abstract- The purpose of this study was to establish the effect of contract management on organizational performance in telecommunication sector in Kenya. The specific objectives were: Contract Planning, Contract administration, contract and dispute resolution on organizational performance in telecommunication sector in Kenya. The study took place at Airtel headquarters, Nairobi along Mombasa road. The study used descriptive research design for this study, where both quantitative and qualitative research was applied to support each other.

Index Terms- Contract Planning, Contract administration, contract and dispute resolution

I. INTRODUCTION

Contract management are the activities of a buyer (KLB) during a contract period to ensure that all parties to the contract fulfill their contractual obligation (Bailey, 2008). Contract life cycle management is the process of systematically and efficiently managing the contract creation, execution and analysis of maximizing operational and financial performance and minimizing (Banyenzaki, 2016). A sales contract is a contract between a company (the seller) and a customer that where the company agrees to sell products and/or services. The customer in return is obligated to pay for the product/services bought. A purchasing contract is a contract between a company (the buyer) and a supplier who is promising to sell products and/or services within agreed terms and conditions. The company (buyer) in return is obligated to acknowledge the goods / or service and pay for liability created (Shah, 2010).

Kakwezi (2012) defines contract management as those activities related to contract handling including invitation to and evaluation of bids; awarding and implementation of contracts; measurement, and payment calculation. This also entails monitoring contract associations, handling related issues, integrating essential contract modifications or changes. This is meant to ensure that all contract parties exceed or meet each other’s expectations and interact with contractor to attain the objectives of the contract. Contract management pertains to preparation of procurement documentation, the processing and approval of such documentation, monitoring contract implementation, approving and administering contract variations and modifications, and possibly cancelling or terminating contracts (Shah, 2010).

Contract administration management contract is the management of contracts made with vendors, customers, employees or partners. Contract management involves negotiating the conditions in contracts and terms and ensuring obedience with the terms and conditions, as well as documenting and harmonizing on any changes or adjustments that may come up during its execution or implementation. It can therefore be summed up as the process of efficiently and systematically, execution and managing contract creation, and analysis for the purpose of maximizing operational performance together with financial and minimizing risk (Rotich, 2014).

Contract life cycle management is the process of efficiently and systematically managing contract creation, analysis and execution for maximizing financial and operational performance and minimizing risk. The foundations for effective and successful post-award contract management rely upon careful, comprehensive and thorough implementation of the upstream or pre-award activities. At the pre-award stages, the emphasis should be concentrated on why the contract is being developed and on whether the supplier is capable to deliver in service and technical terms. However, cautious consideration must be given to how the contract will work once awarded (Sekaran & Bougie, 2013).

A sound contract management of a project revolves around control of cost, time, quality and resources. Cost control means the execution and completion of the project within the agreed time schedule; quality control means execution of the project in conformance with technical requirement and specification; resource control refers to the management resources personnel, equipment, and supplies. These key deliverables in contract are echoed by Meredith and Mantel (2012), who emphasize on planning, monitoring and controlling of time, cost and scope. For each contract entered into, the procuring entity must designate a member of staff, or a team of staff, as the contract administrator responsible for administering the contract. There

1.2.1 Statement of the Problem

With ever turbulent business environment in the telecommunication industry in Kenya, Airtel Kenya has been facing a challenge of increased operating cost dictated by low profit margins (Oluka & Basheka, 2014). In the telecommunication industry Airtel Kenya commands a 25 per cent market share, while Safaricom the market leader has 67 percent,
this has made Airtel Kenya to engage in a mighty battle against Safaricom for Kenya’s growing mobile market. Airtel Kenya has been struggling over the years to gain market share from its competitor Safaricom, but these efforts have not yielded any positive results (Olang, 2017). In 2016 Airtel lost 7.8% of its subscribers, which negatively affected their profits. These challenges facing Airtel Kenya has been attributed to poor contract management, which is attributed to corruption, incompetence and lack of skill among procurement staff (Oluka & Basheka, 2014). Turbulent business environment requires firm to devise strategies to reduce operating cost while maintaining efficiency in operation and quality service delivery, contract management plays a key role in ensuring that this is achieved (Cho & Pucick, 2015). Contract management practice is a vital aspect in any organization that intends to gain a competitive advantage and value for money. A firm’s procurement process is incomplete without an effective and efficient contract management practice. Contract management improves an organisation’s operational performance as indicated by various measures, such as, quality, flexibility, speed, efficiency, and supplier relationship (Olang, 2017).


From the available studies done in the Kenyan context there are few empirical evidence specifically on the areas of contract management on organizational performance in the telecommunication sector itself. This necessitated the need to do a study so as to validate this finding with the available studies. Finally arrive at an agreed consensus and create the new knowledge to bridge the gaps which this study soughed to fill. This study sought to establish the effect of contract management on organization performance in the telecommunication sector in Kenya.

1.2.1 General Objective

The general objective of the study was to establish the role of contract management on organization performance in the telecommunication sector in Kenya.

1.2.2 Specific Objectives

The study was guided by the following specific objectives

1. To determine the role of contract planning on organization performance in the telecommunication sector in Kenya.
2. To assess the role of contract administration on organization performance in the telecommunication sector in Kenya.
3. To find out the role of contract evaluation on organization performance in the telecommunication sector in Kenya.
4. To establish the role of dispute resolution on organization performance in the telecommunication sector in Kenya.

2.3 Contract Management Theory

Contract management theory is thought to relevant for this study in understanding how contract planning has effect on organizational performance in the telecommunication sector, hence it gives a theoretical background for this study. According to Fink (2006) contract management theory can be interpreted as category management, contract administration and contracting processes. While category management is about managing the contracting processes initiation, contract administration is addressed by Douglas (2003) who speaks of contract management as the management of the engagement administration of all term agreements by which means a contract is closed. He stressed that this is the contract management process for ensuring that the right information is in the right place at the right time, to support the whole of the contracting process. In project disciplines, this can be achieved by distributing contract information to all primary project stakeholders to determine and assess an optimal supply base (Cheung & Suen, 2002).

The contracting process is the third interpretation of contract management and is where contract realization is managed. This process is connected to both the category management process and the contract administration process (Douglas, 2003). Contracting processes are initiated by category management and are from there supported by the contract administration process. This administration process is necessary during the whole contracting process in order to assure quality, efficiency and effectiveness (Cheung & Suen, 2002).

2.3.1 Theory of Constraints

Theory of Constraints is thought to relevant for this study in understanding how contract administration has effect on organizational performance in the telecommunication sector, hence it gives a theoretical background for this study. According to Douglas (2003) theorized that the Theory of Constraints (TOC) is a philosophy of management and improvement originally developed by Goldratt and introduced in his book, The Goal. It is based on the fact that, like a chain with its weakest link, in any complex system at any point in time, there is most often only one aspect of that system that is limiting its ability to achieve more of its goal. For that system to attain any significant improvement that constraint must be identified and the whole system must be managed with it in mind. In borrowing this concept, buyers seek to identify the constraints in the supply chain that emanates from poor buyer/supplier relationship and then work collectively to eliminate the constraint thus improving the functions and aspirations of each, more specifically, procurement functions for the buyer (Chiappori & Salanie, 2003). The TOC Thinking Processes, taken as a whole, provides an integrated problem-solving methodology that addresses not only the construction of solutions, but also the need for communication and collaboration that successful implementation of supply chain functions requires (Douglas, 2003).

2.3.2 Transaction Cost Economies Theory

Transaction Cost Economies Theory is thought to relevant for this study in understanding how contract evaluation has effect on organizational performance in the telecommunication sector, hence it gives a theoretical background for this study. According to Ross (1973) Transaction Cost theory might be one of the most
important organization theories because of the studies that have been encouraged trough it and is one of the main perspectives in organizational studies (Douglas, 2003). The vital commitment of Transaction cost economics to organization theory, resulted in a wide range of empirical contributions, using transaction cost economics, for instance as a make or buy decision help, or verification of the right contract mode. Transaction Cost Economics (TCE) inspects how business partners who collaborate with each other shield one another from harmful subsidiary with differing relationships.

It has been the most important new institutional theory which puts the accentuation on the decision on the sourcing predicament, if to outsource or not. The sourcing situation of a firm is likewise described as the make-or-buy decision of a firm (Christopher, 2009). The two primary drivers of Transaction Cost Economics are uncertainty caused by the external environment and costs, which consist of Coordination costs and Transaction costs (Ross, 1973). Transaction Cost Economics focuses on the organization of transactions that occur whenever a good or service is transferred from a provider to a user across a technologically separable interface. When transactions occur within an organization, the transaction costs can include managing and monitoring personnel and procuring inputs and capital equipment. The transaction costs of buying the same good or service from an external provider can include the costs of source selection, contract management, performance measurement, and dispute resolution. Thus, the organization of transactions, or “governance structure,” affects transaction costs. This theory was therefore useful in discussing the role of contract administration and contract evaluation on organization performance (Cheung & Suen, 2002).

They have been used to create powerful generic, “starting-point” solutions for various supply chain inefficiencies, including: Long supplier lead-times, Incoming quality problems, Late or unreliable raw material or purchased part deliveries, Raw material shortages, Poor quality. In this connection then chances are good that an organizations constraint is in the supply chain that it rely on and the policies and practices associated with your relationships with suppliers. The challenge is to get from your suppliers what you need from them to be effective, whether it’s better delivery performance, quality, or other aspect of what they supply to the organization (Christopher, 2009). The main aim of every company is to increase the profit. According to this point of view, constraints are the main obstacles in achieving the aims of companies. In other words, anything that gets in the way of gaining more profit is considered a constraint (Cheung & Suen, 2002). The identification of the constraint is the basis for improving the production system. This theory was therefore applicable in this study in determining the role of Contract Planning on organization performance at Airtel Kenya.

2.3.3 Principle Agent Theory

Principle Agent Theory is thought to relevant for this study in understanding how dispute resolution has effect on organizational performance in the telecommunication sector, hence it gives a theoretical background for this study. According to Cheung & Suen, (2002) an agency relationship is defined as one in which one or more persons (the principal) engage another person (the agent) to perform some service on their behalf which involves delegating some decision-making authority to the agent (Ross, 1973). The cornerstone of agency theory is the assumption that the interests of principals and agents diverge. According to agency theory, the principal can limit divergence from his interests by establishing appropriate incentives for the agent, and by incurring monitoring costs designed to limit opportunistic action by the agent. This study therefore adopts the view that it is prudent to monitor and control the critical factors of project performance (as defined in the Success Factors Model) within a contracting arrangement (as defined in the Agency Theory) to ensure the success of outsourced projects in the organization.

The principal-agent theory can be applied to this study with Airtel company as a principal and project suppliers as agents. According to Fink (2006) the underlying principle of the contract theory is that there should be a clear understanding of the needs of the principal and ability of the agent to meet these needs competently. The theory becomes significant to the study as it highlights the need for strategic planning in project contract management. When a project contract is well defined and planned, the principal and agents will find it easy to meet needs of each other in an efficient way resulting into timely execution of the projects in predetermined service level. According to the principal-agent theory, the relationship between the two parties also involves self-interest of each party. It is commonly assumed that all participants in the project will work together in order to achieve the same goal (Douglas, 2003). However, there is a potential conflict of interests between the participants because they all have their self-interests too. Therefore, agency theory was used to investigate the role contract management on organization performance at Airtel Kenya.

2.4 Contract Planning

Contract planning is concerned with identifying and executing the structure, format and content of the contracting mechanism the organization needs with their partners (Burgess & White, 2015). Good contract planning formalizes relations between parties within a robust legal framework, but is much more besides; it is an opportunity to define the arrangements that encompass every aspect of what outcomes the organization wants from the supplier and how it wants the relationship to work (Ballou, 2017). This means that the organization needs to take an active role in the development of the contractual mechanism early on; it should not be left as a supplementary activity post negotiation. At preparation of every contract the level of contribution to contract quality and risk ensuring needs to be weighted, it is not reasonable to use too much time for negotiating on all details. However, being innovative in the development of contract is not only reasonable but also one of the key factors for success (Haapio & Järvinen 2014). When planning the contract management for the company, following issues should be considered and included: Prevailing contract practices, contract and Agreements and Financial appropriateness.

There are three primary inputs to contract planning - the business requirements, the relationship requirements and the proven standard legal framework or terms relevant to what we are trying to contract for. A contract is the cornerstone to any business transaction. In this economic environment, companies that treat all contracts alike often then fail to realize or meet expectations with regard to logistics, services, quality of procured product or service,
address embedded risks and often fall short of overall business targets. Oluka and Basheka (2014) reveal that clear description of processes and setting contract management plans, suitable methods of using vital lessons from contract management practice, precise definition of roles and employing knowledgeable contract manager enhance effective contract management process. CMKN (2012) highlights some of the factors that contribute to inefficiency in public procurement in Kenya’s public procurement. One of the factors identified was poor planning which negatively affects public procurement in the country (Goldratt, 2017).

Improving the area of contractual controls should be a focus for most companies. In recent studies it has been shown that ineffective control and management of supplier contracts costs businesses $153 billion per year in missed savings opportunities and increased risks. Oluka and Basheka (2014) reveal that clear description of processes and setting contract management plans, suitable methods of using vital lessons from contract management practice, precise definition of roles and employing knowledgeable contract manager enhance effective contract management process. According to Munive-Hernandez, Dewhurst, Pritchard and Barber (2014), planning involves the plan or pattern of act that adds company main goals, policies and action systems are unified into a whole. According to Ballou (2017), planning also involves developing the tracking and assessment method that will be used to monitor the project process. To build your company to a performing level within the industry, the business has to strategize and employ the use of strategic planning practices. These are key characteristics which are vital towards founding and positioning the business strategically in the market (Mutua, 2014).

Contracts may be complex but the dynamics that govern their creation are simple: one side wants the largest amount of revenue, the other the smallest expense. Regardless of the values attributed to your contractual position, one lesson is vital - the value of a contract is realized only after it is signed. One issue holds true - tuck your contracts away in a drawer and you could not only lose out on benefits you’ve sought to secure, but also increase your risk and limit performance. You could be opening yourself up for a multitude of new risks. Types of contract risk that can erode the value of a contract include poor or perverse incentives, bad planning and demand management, ill-informed buying, deliberate contract manipulation, embedded options, elaborate pricing structures, and miscommunication (Mutua, 2014). Success of the contract depends on the information captured regarding the terms of the contract and the strategic objectives leading to the contractual relationship. How often do the organization review the contracts and documentation of discoveries made, How organization get the information they need to monitor and manage the suppliers, How they measure the value they get from suppliers, how they monitor pricing adjustments, price list additions or other amendments that have altered the original contract? One of the major functions of contracting is to ensure that risks to owners and contractor are identified and managed in a way that both parties are satisfied with the project outcome (Nair & Vinod 2015).

2.4.1 Contract Administration
This procedure involves maintaining an updated form of the contract; controlling and managing contract variations; paying the contractor; managing assets; drafting reports; and terminating the contract (Hansson & Longva, 2014). Contract administration starts with developing clear, concise performance based statements of work. The statement of work should be the roadmap for contract administration. Therefore, planning for contract administration occurs prior to issuance of the solicitation. The goal of contract administration is to ensure the contract is satisfactorily performed and the responsibilities of both parties are properly discharged. Effective contract administration minimizes or eliminates problems and potential claims and disputes. A key factor in successful contract administration is communication. It is essential for contract administrators to understand the provisions of the purchase document, have the ability to communicate contract obligations to all parties involved, and maintain control over the contract performance. A good contract manager ensures that the contract requirements are satisfied, that the goods and services are delivered in a timely manner, and that the financial interests of the agency are protected (Nair, & Vinod, 2015).

Contract managers must have sufficient knowledge of contracting principles as it relates to their responsibilities in administering the contract. It is the contractor’s responsibility to perform and meet the requirements of the contract. To do so, contractors sometimes need technical direction and approval from agency personnel. Agency personnel must provide this technical direction and approval in a timely and effective manner. All guidance provided to a contractor must be within the scope of the contract (Trent, 2013) Monitoring focuses on collecting and analysing information to provide assurance to the acquiring entity that progress is being made in line with agreed timeframes and towards providing the contract deliverables. Monitoring can be undertaken directly by the acquiring entity or through a third party arrangement. Monitoring the performance of suppliers is a key aspect of P&SM and one that requires a range of skills, in particular relationship management. It is the responsibility of the P&SM professional to negotiate and agree appropriate performance criteria at the time the contract is let and these measures, together with a commitment to continual improvement should be clear to all concerned. The level and frequency of performance monitoring is dependent on the value and criticality of the contract to the buying organisation; it need not be the P&SM professionals that carry out this function or indeed the wider role of contract management, however the function should always be supported by the P&SM team (Umana, 2019).

2.4.2 Contract Evaluation
Contract evaluation encompasses the overall performance of the contract and of the acquiring entity’s management of the contract. The evaluation of the operation of the contract and of contract outcomes is very useful in understanding and improving overall contract management, improving contractor performance and also assists in future stakeholder decision-making (Venkatraman & Ramanujam, 2010). An evaluation should be undertaken at the end of all contracts and should be planned for in advance. When a transition from one contract to another is to occur, it is better practice for an evaluation to be undertaken before the contract ends so that any problems that have occurred with aspects of the contractual arrangement are identified and, where appropriate, improvements made in the future contractual arrangements (Prosidian, 2014).
Evaluations can be conducted in-house by the acquiring entity or a third party can be contracted to undertake the evaluation (Smith, Peter, Damien & Peter, 2014). This latter approach has advantages in providing an independent view of the contracting arrangement. The organization should have the following for evaluation to be successful: an evaluation plan that sets out clear terms of reference, methods and sources of data collection and analysis, budget, clear timeframes and reporting arrangements; relevant skills to manage and conduct the evaluation (either in-house or through contracted personnel); senior management support; an evaluation report in which conclusions are supported by the data; and recommendations that provide an indication of their likely benefits (Robson, 2013). For contracts, the evaluation should be a thorough and independent review that is informed by those involved in establishing and managing the contract. The evaluation will need to be tailored to the particular circumstances but should consider both the effectiveness and efficiency of the arrangement. To get the best out of the evaluation, entities should: review all aspects of contract performance and its management; provide feedback to the contractor; this should not be done as part of another procurement process; report to stakeholders; and identify lessons learned (Bartsiotas, 2014).

2.4.3 Dispute Resolution

Dispute resolution is the process of resolving disputes between parties. If disputes are not properly managed, they may cause project delays, undermine team spirit, increase project costs, and, above all, damage business relationships (Rob & Simon, 2012). With the increase in the number of participants in a construction project, more business interactions and arguments end up with an increase in the number of construction disputes (Robson, 2013). Research in preventing and resolving disputes supports the effort for better understanding and harmonization of the different cultures (Sekaran & Bougie, 2013). It was rightly stated “without understanding there can be no friendship. If one wishes to understand a people one must identify oneself with them. One must study their language, customs and culture and they will be one’s friend”. The study of Rob and Simon (2012) provided a good reference of the common sources of construction disputes.

The sources of construction disputes are largely related to contractual matters, including variation, extension of time, payment, quality of technical specification, availability of information, administration and management, unrealistic client expectations and determination. On the other hand, the works of Sekaran and Bougie, (2013) and Centre for Public Resources suggested that disputes could be caused by cultural and contractual matters, and Osoro et al. (2015) believed that conflict of laws and jurisdictional problems could also lead to disputes, and therefore, these sources should not be overlooked. Taking into account the literature, a consolidated list of sources of disputes was developed by Otieno (2010), in his study of dispute management of international construction projects. The list includes variations, extension of time, payments, quality of works, technical specification, and availability of information, management, unrealistic client expectations, risk allocation, project scope definition, poor communication, difference in ways of doing things, lack of team spirit, previous working relationships, adversarial approach in handling disputes, unfamiliar with local conditions, conflict of laws, jurisdictional problems, lack of local legal system, and unclear contractual terms.

2.4.4 Organizational Performance of Telecommunication Sector

The main objective of the organizations is to make profits, for this to be achieved it must be doing well on different functions of the organization, including procurement function. Procurement can play this important role by proper contract management (Robson, 2013). A relevant aspect related to contract management is to link the contract management with the overall buying firm’s corporate strategy; this will enable organizations to realize that proper contract management can save the organization enormous profits. Organizational performance is measured by looking at its overall profitability, cost structure and how buyers are being treated by the sale representatives. Modern institutions have seen the need of proper contract management, which include reduction on overall cost of the organizations, which impact positively on the profit margins (Otieno, 2010).

With reference to Piga and Treumer (2013), in a procurement department where contract management practices take place, a number of operational performance measures are essential. Firstly, supplier defect rate is a key operational performance indicator used to measure the quality of purchases carried out by a procurement department. This can be achieved by dividing the number of defects by the total purchases, or defective shipments by total shipments. Operational performance can also be measured by use of customer satisfaction indicator. Internal customers’ rating on their satisfaction levels with the department’s performance is essential in achieving this. If many firms use similar questions, benchmarking levels of satisfaction is achievable. Customer satisfaction helps in measuring the department’s capacity to meet the needs and expectations of internal customers (Robson, 2013). According to Venkatraman and Ramanujam (2017) empirically demonstrated that growth and profitability were distinctly different measures of performance. Sales growth, profit growth, and profitability are discriminate measures of different dimensions of business performance. Sales growth was represented by the percentage change in sales for each company in the sample over a single year, adjusted for the industry average based upon the firm’s primary SIC code. Profit growth was operationalized as the percentage change in net income over one year adjusted for the industry average. The profitability construct was represented by return on investment (Robson, 2013).

In business, the purpose of the return on investment (ROI) metric is to measure, per period, rates of return on money invested in an economic entity in order to decide whether or not to undertake an investment (Otieno, 2010). It is also used as an indicator to compare different investments within a portfolio. Internal measures for organizational performance focus on process efficiency and goal achievement efficiency. These methods evaluate performance through the gap between target and current position. The common measure that was used in this study was ROI. It is often required to calculate return on investment (ROI) of the projects based on objective data and measurable results. Calculating the return on investment helps justify the resources invested in the initiatives and assess financial performance of the initiatives. In terms of cost and benefit, the ROI calculation may...
be done simply by dividing the value of benefits by the cost spent on the project (Robson, 2013).

1.5 Research Design

A research design is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the problem research (Kothari, 2011). This study utilized the descriptive research design. The census survey descriptive research design involves posing a series of questions to willing participants, summarizing their responses with percentages, frequency counts, and other statistical indexes and then drawing inferences about a particular population from the responses of the sample (Osei-Tutu, 2016). This research design is ideal for this study as the researcher is interested in gaining knowledge on the factors affecting the implementation of procurement policies and procedures in Nairobi City County. This design was therefore deemed appropriate in determining the role of contract management on organization performance in the telecommunication sector in Kenya.

Target population refers to the larger population to which the researcher ultimately would like to generalize the results of the study (Kothari, 2011). It is thus the entire group of individuals, events or objects having common observable characteristics. The target population for this study was 87 the Airtel employees at Nairobi city county. This was our unit of observation. The population of this study consists of the staff working in the following departments: supply chain management, accounts and administration respectively. The target population for this study all the users / respondents employees at Airtel.

<table>
<thead>
<tr>
<th>Category</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Chain Management Officers</td>
<td>35</td>
</tr>
<tr>
<td>Accounts Officers</td>
<td>35</td>
</tr>
<tr>
<td>Administration officers</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
</tr>
</tbody>
</table>

Source: Airtel Kenya HRM Records

A sample is portion or part of the population of interest (Kothari, 2011). The study was a case survey with the respondents with different educational levels. The study purpose sampling techniques to be used. The purpose of sampling is to gain an understanding about some features or attributes of the whole population based on the characteristics of the sample. The Yaro Yamane’s simplified formula as provided by Njiru (2012) was used for the calculation of the sample size. The proportionate random sampling was utilized for the study.

The multiple linear regression analysis was undertaken to examine the manner in which the independent variables influenced the dependent variable, adherence to the contract management at Airtel Kenya and organizational performance of telecommunication sector in the Nairobi City county governments is only cumulatively accounted for by the contract planning, contract administration, contract evaluation and dispute resolution. The following Formula for multiple linear Regression was expressed as follows:

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

Where

\( Y = \) Organizational performance of telecommunication sector
\( \beta_0 = \) Constant (coefficient of intercept)
\( \beta_1, \beta_2, \beta_3, \beta_4 = \) Contract Planning, Contract Administration, Contract Evaluation, Dispute Resolution

An Analysis of Variance was used to measure statistically the significance in predicting variables in Organizational performance of telecommunication sector. The test of significance was correlated coefficient, the R square as a measure of significance. The coefficient is a standard measure of an assumed linear relationship between variables. A coefficient of value (+ve) 0.5 and (-ve) 0.5 or higher indicates a strong Relationship and by extension a significant variable in influencing the trend of dependent variable.

2.1 Reliability Test

For this study, a pilot study was undertaken at Airtel Kenya for which nine respondents who were randomly selected from the entire targeted of 87 respondents. Those who participated in the pilot study did not participate in the actual data collection. The pilot testing established the validity and reliability of the research questionnaire. The reliability statistics are presented in the table 4.2 below:
Table 2.1: Reliability Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>No of Items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Planning</td>
<td>9</td>
<td>0.839</td>
</tr>
<tr>
<td>Contract Administration</td>
<td>9</td>
<td>0.793</td>
</tr>
<tr>
<td>Contract Evaluation</td>
<td>9</td>
<td>0.812</td>
</tr>
<tr>
<td>Dispute Resolution</td>
<td>9</td>
<td>0.787</td>
</tr>
<tr>
<td>Organization Performance</td>
<td>9</td>
<td>0.754</td>
</tr>
</tbody>
</table>

N=9

In Table 2.2 the scale reliability measure, Cronbach’s Alpha for the independent and dependent variables was determined to check on the reliability of the instruments used by determining the internal consistency of the scale used. Cronbach’s Alpha for each value was established by the SPSS application and gauged against each other at a cut off value of 0.7 that is acceptable according to (Kothari, 2011). Cronbach’s Alpha is a reliable coefficient that indicates how well items are positively related to one another. Therefore, for this study, it was established that the variables met the minimum acceptable cut-off of 0.7. This findings is in line with the findings of Oliveira (2015).

2.2 Contract Planning

Respondents were asked to give their responses in regard to contract planning in a five point Likert scale where SA=Strongly Agree, A=Agree, N= Neutral, D=Disagree, and SD= Strongly Disagree. Results obtained were presented in Table 2.2 below:

Respondents were asked to give their opinion on the variable contract planning. From table 4.6, the respondents were in agreement that Airtel Kenya ensured contract identification and periodic review on viable projects (M=3.884, SD=1.0720); Through contract assessment the organization has been able to make rational decisions on priority and non-priority projects (M=3.885, SD=.9575); Contract assessment has contribution to the quality and innovation of the planning team (M=4.000, SD=.9524); In order to avoid over expenditure in contract management it is important to put in place and maintain a contract budgeting register (M=4.161, SD=.8355); The management of Airtel Kenya implements contract budgeting to prevent project overruns (M=3.943, SD=1.0383); and Contract planning enhances organization performance at Airtel Kenya (M=3.931, SD=.8599).

These findings were in line with the findings of Otieno (2014), who observed that clear description of contract management planning, can enhance effective contract management process. Thus leading to organizational performance of telecommunication sector in Kenya.

N=63

2.3 Contract Administration

Respondents were asked to give their responses in regard to contract administration in 5 point Likert scale where SA=Strongly Agree, A=Agree, N= Neutral, D=Disagree, and SD= Strongly Disagree. The results obtained are as presented in Table 2.3.

From table 2.3, respondents agreed that: The organization considers personal qualification on appointing contract implementation teams (M=3.930, SD=.8183); A professionally qualified contract implementation team is likely to deliver based on the required terms of reference (TORs) (M=4.070, SD=.7593); Contract monitoring can ensure mutual satisfaction to both the contractor and the buying organizations (M=4.093, SD=.7254); Through contract monitoring the organization has been able to get quality and meet the demands of time, budget and scope of many completed contracts (M=4.023, SD=.7772); Administrators of contracts are supposed to maintain a documentation system of
every correspondence that arise before, during and after contracts (M=4.081, SD=.8243); and Contract administration enhances our organizations performance (M=4.060, SD=.9194). These findings concur with CIPS (2011) that the goal of contract administration is to ensure the contract is satisfactorily performed and the responsibilities of both parties are properly discharged. Effective contract administration minimizes or eliminates problems and potential claims and disputes. This is in line with the finding of Olang (2017). It is essential for contract administrators to understand the provisions of the purchase document, have the ability to communicate contract obligations to all parties involved, and maintain control over the contract performance.

### Table 2.3 Contract Administration

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>My organization considers personal qualification on appointing contract implementation teams.</td>
<td>3.930</td>
<td>.8185</td>
</tr>
<tr>
<td>A professionally qualified contract implementation team is likely to deliver based on the required terms of reference (TORs).</td>
<td>4.070</td>
<td>.7593</td>
</tr>
<tr>
<td>Contract monitoring can ensure mutual satisfaction to both the contractor and the buying organizations.</td>
<td>4.093</td>
<td>.7254</td>
</tr>
<tr>
<td>Through contract monitoring my organization has been able to get quality and meet the demands of time, budget and scope of many completed contracts.</td>
<td>4.023</td>
<td>.7772</td>
</tr>
<tr>
<td>Administrators of contracts are supposed to maintain a documentation system of every correspondence that arise before, during and after contracts.</td>
<td>4.081</td>
<td>.8243</td>
</tr>
<tr>
<td>Contract administration enhances our organizations performance</td>
<td>4.060</td>
<td>.9194</td>
</tr>
</tbody>
</table>

N=63

### 2.4 Contract Evaluation

Respondents were asked to give their responses in regard to contract evaluation in 5 point Likert scale where SA=Strongly Agree, A=Agree, N= Neutral, D=Disagree, and SD= Strongly Disagree. The results obtained were as presented in Table 4.8 below:

The findings presented in table 2.4 show that respondents agree that: the organization conduct post contract reviews to assess the performance levels of the deliverables attained (M=3.941, SD=.8120); the organization reviews contract performance to ensure management of costs in future contracts (M=3.894, SD=.7475); Through contract control/ audits the organization has been able to identify areas of weaknesses and strengths of different contracts (M=4.047, SD=.6973); Contract audit and control is significant when you want to develop corrective actions on contracts (M=4.106, SD=.6474); Contract Appraisal enhances our organizational performance (M=3.976, SD=.7621); and through evaluation, the organization is able to identify problems and find solutions in a timely manner to ensure high quality of the goods and services delivered (M=4-.059, SD=.7526).

The findings is in line with the finding of Bartsiotas (2014), who argued that it is critical to monitor a contract’s performance frequently and at regular intervals after award to ensure that the contractor is providing the goods and services on schedule and within budget, and that quality standards are being met, especially for the highest-risk and most complex contracts. Assessing post-award performance entails several activities to ensure that the delivery of services meets the terms of the contract. These include identifying performance criteria, such as key performance indicators (KPIs), at the time of contract formulation, and providing adequate monitoring resources and a capable workforce for overseeing contractor activities, by so doing performance of an organization will improve due to the fact that cost will reduce that comes with poor performance.

### Table 2.4. Contract Evaluation

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our organization conduct post contract reviews to assess the performance levels of the deliverables attained.</td>
<td>3.941</td>
<td>.8120</td>
</tr>
<tr>
<td>Our organization reviews contract performance to ensure management of costs in future contracts</td>
<td>3.894</td>
<td>.7475</td>
</tr>
<tr>
<td>Through contract control/ audits the organization has been able to identify areas of weaknesses and strengths of different contracts.</td>
<td>4.047</td>
<td>.6973</td>
</tr>
</tbody>
</table>
2.5 Dispute Resolution

Respondents were asked to give their responses in regard to dispute resolution in a 5-point Likert scale where SA=Strongly Agree, A=Agree, N= Neutral, D=Disagree, and SD=Strongly Disagree. Their responses are presented in Table 2.5 below:

From table 2.5, respondents agreed that the organization implements contract enforcement policy to ensure every party involved in the contract administration process performs their responsibility (M=4.035, SD=.6725); Contract enforcement policy hedges against breach of contracts. (M=4.093, SD=.7092); Collective bargaining in cases of disputes ensures both parties are satisfied and hence productivity (M=4.198, SD=.7123); In cases of contract disputes, our organization employs alternative dispute resolution processes so as to mutual agreement (M=4.140, SD=.7179); Alternative dispute resolution process contributes to control of contract management and cost control (M=4.081, SD=.6685); and to enhance dispute resolution results, our organization has created a conducive environment that ensures each party is free to express its concerns (M=4.093, .8576).

These findings agree with are in line with the finding of Rotich (2014) who observed that the characteristics of international projects in China, cultural and legal matters are also found to be the sources of problem and indicated that Mediation is the most popular method, after negotiation, for resolving disputes in international construction projects in China. The problem areas giving rise to disputes are mainly related to contractual matters. If disputes are resolved outside the court it will reduce on the cost of expensive court procedures hence impacting positively on the profits.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>My organization implements contract enforcement policy to ensure every</td>
<td>4.035</td>
<td>.6725</td>
</tr>
<tr>
<td>party involved in the contract administration process performs their</td>
<td></td>
<td></td>
</tr>
<tr>
<td>responsibility.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract enforcement policy hedges against breach of contracts.</td>
<td>4.093</td>
<td>.7092</td>
</tr>
<tr>
<td>Collective bargaining in cases of disputes ensures both parties are</td>
<td>4.198</td>
<td>.7123</td>
</tr>
<tr>
<td>satisfied and hence productivity.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In cases of contract disputes, our organization employs alternative</td>
<td>4.140</td>
<td>.7179</td>
</tr>
<tr>
<td>dispute resolution processes so as to mutual agreement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative dispute resolution process contributes to control of</td>
<td>4.081</td>
<td>.6685</td>
</tr>
<tr>
<td>contract management and cost control.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>To enhance dispute resolution results, our organization has created a</td>
<td>4.093</td>
<td>.8576</td>
</tr>
<tr>
<td>conducive environment that ensures each party is free to express its</td>
<td></td>
<td></td>
</tr>
<tr>
<td>concerns.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N=63

3.1 Model of Goodness Fit

Regression analysis was used to establish the strengths of relationship between the Organizational performance of telecommunication sector (dependent variable) and the predicting variables; contract planning, contract administration, contract evaluation and information and dispute resolution (independent variables). The results showed a correlation value (R) of 0.754 which depicts that there is a good linear dependence between the independent and dependent variables. This finding is in line with the findings of Osoro et al. (2015). This finding is in line with the findings of Mugo (2014), who observed that this also depicted the significance of the regression analysis done at 95% confidence level. This implies that the regression model is significant and can thus be used to evaluate the association between the dependent and independent variables. This finding is in line with the findings of Cherotich (2014), who observed that analysis of variance statistics examines the differences between group means and their associated procedures.
The study recommends and confirms that the implementation of organizational performance of telecommunication sector was significant in enhancing contract planning in Airtel in Nairobi City County in Kenya. That in future different counties needs to strengthen organizational performance of telecommunication sector in the procurement process to all counties in Kenya, so as contract planning, contract administration, contract evaluation and dispute resolution to be line with the implementation of organizational performance of telecommunication sector. This study therefore sought to explore what past scholars had said on the influence of organizational performance of telecommunication sector in Kenya and tested viability of best procurement policy and procedures in the public entities in Kenya. That from the foregoing, this study recommends that the best organizational performance of telecommunication sector in Kenya should strive to be proactive in how to perform better to retain integrity and improve transparency and accountability in organizational performance of telecommunication sector. The study has now filled the existing gap after the creation of this new knowledge.

**REFERENCES**


**Table 3.1 Model Goodness of Fit**

<table>
<thead>
<tr>
<th>R</th>
<th>R²</th>
<th>Adjusted R</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.754</td>
<td>0.727</td>
<td>0.716</td>
<td>0.059</td>
</tr>
</tbody>
</table>

a. Predictors: (Constants), contract planning, contract administration, contract evaluation and dispute resolution

b. Dependent Variable: organizational performance of telecommunications sector

With an R-squared of 0.727, the model shows that contract planning, contract administration, contract evaluation and dispute resolution can contribute up to 72.7% of the variations on organizational performance of telecommunications sector while 27.3% is explained by other indicators which are not inclusive in this study or model. A measure of goodness of fit synopses the discrepancy between observed values and the values anticipated under the model in question. This finding is in line with the findings Cherotich (2014).

**II. CONCLUSION**

Therefore, from the foregoing, this study concludes that contract planning has broadly impacted on organizational performance of telecommunication sectors in Kenya. The findings conclude that modern institutions should drive to embrace the best Contract Planning, Contract administration, contract and dispute resolution on organizational performance in telecommunication sector in Kenya. When public-private partnerships is embraced through contract planning, contract administration, contract evaluation and dispute resolutions then the implementation of organizational performance of telecommunication sectors in Airtel Kenya.

**III. RECOMMENDATIONS**

The study recommends and confirms that the implementation of organizational performance of telecommunication sector was significant in enhancing contract planning in Airtel in Nairobi City County in Kenya. That in future different counties needs to strengthen organizational performance of telecommunication sector in the procurement process to all counties in Kenya, so as contract planning, contract administration, contract evaluation and dispute resolution to be line with the implementation of organizational performance of telecommunication sector. This study therefore sought to explore what past scholars had said on the influence of organizational performance of telecommunication sector in Kenya and tested viability of best procurement policy and procedures in the public entities in Kenya. That from the foregoing, this study recommends that the best organizational performance of telecommunication sector in Kenya should strive to be proactive in how to perform better to retain integrity and improve transparency and accountability in organizational performance of telecommunication sector. The study has now filled the existing gap after the creation of this new knowledge.
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www.ijsrp.org
Learning Model for Entrepreneurship Course to Generate Madurese Students’ Entrepreneurial Intention

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Abstract- The Madurese community is considered having a work ethic inherited from their ancestors having a philosophy of cushioned by waves, blanketed in the wind, and protected under the umbrella of prayer mat. In other words, the Madurese are described as hardworking and tireless people. These obviously relate to entrepreneurs whose roles are very essential to increase the economic sector of a country as well as the economic growth of the Madurese community in particular. Therefore, this study investigated university graduates as educated people who are highly demanded to enter the entrepreneurship society. This was an explanatory research with a survey to Madurese native students. The samples were taken with accidental sampling method to Madurese students who are currently taking entrepreneurship courses at the University of Madura. As the results, this study indicated that the variable of learning model for entrepreneurship subjects had a significant effect on the entrepreneurial intention of students in Madura, with a significant value of 0.385. Then, the variables of personal character, independent attitude, and emotional intelligence mediated the significant effect of entrepreneurship learning model on students' entrepreneurial intention with the Sobel test scores of 2.244, 3.994 and 2.536 respectively.

Index Terms- Learning Model of Entrepreneurship, Entrepreneurial Intention, Madurese Students

I. BACKGROUND OF THE STUDY

Higher education obviously prepares students to access a society with academic and professional abilities. Incorporating entrepreneurship as a subject in the higher education is one of strategies that the government has implemented to develop the numbers of entrepreneurs in Indonesia. The universities also carry out the learning model for entrepreneurship by establishing campus entrepreneurship centres that provide various activities, such as: seminars, training, workshops, business practices, and cooperation with business entities and industries. Learning entrepreneurship are aimed to broaden students’ insight into entrepreneurship and to motivate students for actively being young entrepreneurs who are able to contribute for Indonesian economy improvement.

The Madurese communities are described to have a higher work ethic, so they are expected to be successful entrepreneurs. They never give up and like challenges as inherited from their ancestors for having characters of enthusiasm, perseverance, and independence. Referring to the Madurese philosophy: cushioned by waves, blanketed in the wind, and protected under the umbrella of prayer mat, the Madurese are identified as hardworking and tireless people who intend to give life completely to the Almighty God.

In other words, they have to be brave and patient to carry out whatever challenges and how big obstacles are faced. However, Madurese graduates (Sarjana degree) prefer finding jobs rather than creating jobs today. The greater numbers of bachelor graduates have affected higher unemployment rates in Madura. The misbalancing between working opportunities and fresh graduate quantities lead for joblessness. Thus, entrepreneurs are required to suppress high unemployment amounts. Schumpeter (2012) states that entrepreneurs play important roles of economic activities within a country. In particular, entrepreneurs are also essential to increase the community’s economic growth in Madura.

II. THEORETICAL REVIEW AND HYPOTHESIS

A practical learning model for an entrepreneurship course can affect students’ entrepreneurial intention. Joyce and Weil (1996:56) designate the model as the functional learning situation from planning a course, designing entrepreneurial education materials, determining literature and practice, developing programs and proficiencies. Maresch et al. (2016) state that entrepreneurship courses have a significant effect on students' interest in entrepreneurship. The students' intention on entrepreneurship are not generated from their births, but are developed from particular factors (Bygrave, 2003: 17). Moreover, the students' interest in entrepreneurship can be affected from the presence of high soft skills. Being an entrepreneurial student requires a variety of skills, such as: personal character, independent attitude, and strong emotional intelligence. Principally, the students' intention in entrepreneurship is formed from internal and external factors (Cano and Tabares, 2017).

Good entrepreneurial learning model, indeed, can develop students’ mind set, attitudes, and behaviour to be real entrepreneurs; and the model has a significant effect on students' entrepreneurial intention as a career choice (Ramadhan and Nurnida, 2017; Farouk and Ikram, 2014). On the other hand, Maryanti et al. (2017) and Mopangga (2014) find that the learning model for entrepreneurship courses in the university have no significant effect on students' intention on entrepreneurship. The latest students mainly prioritize completing the entrepreneurship
courses only for good grades and attendance levels, perceiving no assignments, ignoring knowledge accomplishment, having no entrepreneurial spirits, and lacking supports from parents and family. Drawing to Bygrave (2003:107), students' entrepreneurial intentions are not generated from their births, but are developed as the results of interactions with several factors. Thus, the first hypothesis is as follow:

H1 : Learning model of entrepreneurship had an effect on Madurese students’ entrepreneurial intention.

In addition, there is a relationship between students’ personal character and entrepreneurship course. Kusmintarti et al. (2016) argue for a significant effect of students’ personal character in mediating the learning model on entrepreneurship courses. In contrast, Vilathuvahna and Nugroho (2015) state that the entrepreneurship learning model have no significant effect on students’ entrepreneurial intention. Moreover, Wu and Wu (2008) convey that universities need to apply a concrete entrepreneurial learning model that is based on empirical input to prepare students with meaningful knowledge for advancing their entrepreneurial intention. The students’ personal character and entrepreneurial interests are in relation to their hereditary character, behavior, and attitude towards their life struggle in attaining inner and outer happiness (Meredith, 2005: 56).

H2 : Personal character mediated the effect of entrepreneurship learning model on students’ entrepreneurial intentions.

Then, an independent attitude refers to students’ desire and behavior for not depending to other people to complete their assignments and responsibilities. According to Srihasinita (2016) and Tshikovhi and Shambare (2015), that entrepreneurship learning in a university has a significant effect on students’ independent attitudes. But Lawan et al. (2015) state that the students’ independent perceptions and attitudes on the learning model have no significant effect on the entrepreneurship courses. Then, Rosmiati et al. (2015) believe that the students’ independent attitude have no significant effect on their entrepreneurial intentions. While Slameto (2003: 180) state that the character of independency can be learned depending on how students react to a situation and considering what they are looking for lives without involving other people.

H3 : The students’ independence character mediated the effect of entrepreneurship learning model on their entrepreneurial intentions.

Emotional intelligence is defined as the students’ ability to motivate themselves, resilience to failure, control emotions, delay satisfaction, and regulate mental states (Goleman, 1999:187). In some researches, Zakarevicius and Aurimas (2010) and Ifham and Helmi (2002) state that learning model of entrepreneurship has a significant effect on emotional intelligence. Meanwhile, Najafi et al. (2014) argue that the emotional intelligence (self-regulation, motivation and students’ social skills) has no significant effect on the learning competence of entrepreneurship subject. Paulina and Wardoyo (2012) find that emotional intelligence has a significant effect on student interest in entrepreneurship. However, Khatoon (2013) state that emotional intelligence is a significant difference for students’ entrepreneurial intentions.

H4 : Emotional intelligence mediated the effect of entrepreneurship learning model on students’ entrepreneurial intentions.

Furthermore, the theoretical framework of this study is demonstrated as the following figure:

**Figure 1. Conceptual Framework**

III. RESEARCH METHOD

This study was an explanatory research with a survey to Madurese native students. The population of this study were 3,826 students. The total samples were considered as the proportion of overall Madurese students who had taken and were currently taking entrepreneurship courses at the University of Madura. Then, the samples were taken with accidental sampling method so the number of participants were 362 students, consisting of 53% females (192 respondents) and 47% males (170 respondents). Furthermore, the research data were analyzed using SEM (Structural Equation Modeling) method.

IV. RESEARCH RESULTS

Respondent Descriptions

In this study, the respondents aged 21-25 were about 46.1%; the respondents aged 17-20 years were 38.7%; the respondents aged 26-30 were 11.1%; and the rest respondents
were over >30. They were categorized as having the same age and mature to provide useful information and perceptions for this research questionnaire. The majority of respondents were female with a total of 192 people (53.0%) and male respondents were 170 people (47.0%).

Furthermore, structural feasibility testing was carried out so that several model feasibility indices would be used as the following table:

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Cut–Off Value</th>
<th>Measurement Results</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi – Square</td>
<td></td>
<td>483.504</td>
<td>$\chi^2$ with df = 176</td>
</tr>
<tr>
<td>Significance Probability</td>
<td>$\geq 0.05$</td>
<td>0.000</td>
<td>Worse</td>
</tr>
<tr>
<td>RMSEA</td>
<td>$\leq 0.08$</td>
<td>0.070</td>
<td>Good</td>
</tr>
<tr>
<td>GFI</td>
<td>$\geq 0.90$</td>
<td>0.895</td>
<td>Good</td>
</tr>
<tr>
<td>AGFI</td>
<td>$\geq 0.90$</td>
<td>0.862</td>
<td>Adequately Good</td>
</tr>
<tr>
<td>CMIN/DF</td>
<td>$\leq 2.00$</td>
<td>2.747</td>
<td>Adequately Good</td>
</tr>
<tr>
<td>TLI</td>
<td>$\geq 0.90$</td>
<td>0.918</td>
<td>Good</td>
</tr>
<tr>
<td>CFI</td>
<td>$\geq 0.90$</td>
<td>0.932</td>
<td>Good</td>
</tr>
</tbody>
</table>

As the criterion evaluation result of Goodness of Fit Indices on the first table, this study indicated that the models were accepted so that further analysis could be conducted as the requirement.

VI. HYPOTHESIS TESTING RESULTS

The hypothesis testings were conducted as the analytical results on the relationships between research causality and constructs. These were presented on the following table:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Koefisien</th>
<th>S.E</th>
<th>CR</th>
<th>Prob.</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Entrepreneurship Model of Students’ Intensions (MB)</td>
<td>0.385</td>
<td>0.119</td>
<td>2.738</td>
<td>0.006</td>
<td>Significant</td>
</tr>
<tr>
<td>Learning Entrepreneurship Model of Personal Character (KP) → Students’ Intensions (MB)</td>
<td>0.853</td>
<td>0.061</td>
<td>12.019</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>Learning Entrepreneurship Model of Independence Attitude (SM) → Students’ Intensions (MB)</td>
<td>0.191</td>
<td>0.084</td>
<td>2.246</td>
<td>0.025</td>
<td></td>
</tr>
<tr>
<td>Learning Entrepreneurship Model of Emotional Intelligence (KE) → Students’ Intensions (MB)</td>
<td>0.780</td>
<td>0.054</td>
<td>12.655</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>Learning Entrepreneurship Model of Students’ Intensions (MB)</td>
<td>0.792</td>
<td>0.061</td>
<td>13.641</td>
<td>0.000</td>
<td>Significant</td>
</tr>
</tbody>
</table>

VI. DISCUSSION

In this study, the learning model of entrepreneurship subject affected the entrepreneurial intention of Madurese students. It can be said that better entrepreneurship learning model made better interest in entrepreneurship among Madurese ethnic students. Therefore, it was very noteworthy to pay attention to the learning model for entrepreneurship courses that were adjusted to the students’ conditions. They were perceived to have an influence.
on students' intentions on entrepreneurship. In fact, there was a continuity between the real condition and the learning model of entrepreneurship courses that had been implemented by lecturers. The practical learning models were expected through direct business practices in the university, in the forms of case studies, group discussions, group projects, action learning, seminars, and other learning models that emphasized on entrepreneurial practices. Such application of entrepreneurial learning model would lead students feeling more responsible, independent, disciplined, and creative to develop an entrepreneurial interest and to establish a self-determining business. The entrepreneurial-based learning should developed by formulating a system or method of entrepreneurship learning and training. Then, the universities must design entrepreneurship courses or materials that are tailored to the learning targets to be achieved.

Moreover, particular learning model of entrepreneurship courses encouraged lecturers to provide strategies in order to escalate Madurese students’ entrepreneurial interest. They might influence students taking entrepreneurship in order to gain profit and to be free in managing their own business management. This study also reinforced a research of Wu and Wu (2008) showing a good entrepreneurship learning model to actualize students’ interest in entrepreneurship due to profit and free time for business management. Indeed, this requires self-knowledge to make good decisions on how to spend time and motivate themselves in starting an independent business. Thus, personal character can mediate the relationships between the learning model of entrepreneurship courses and students’ interest in entrepreneurship by obtaining a significant probability. So the variable of learning model was significant towards the variable of personal character. Then, the personal character variable was significant to the students’ entrepreneurial interest, so the student’s personal character variable was partially mediated.

An independent attitude could mediate the effect of learning model in entrepreneurship courses on students’ interest in entrepreneurship with significant results. So the variable of learning model was significant to the independent attitude variable. While the independent attitude variable was significant to the student’s entrepreneurial interest variable. So the student’s independent attitude variable was a partial mediation. A good learning model for entrepreneurship could form students’ independent attitudes and behavior to become entrepreneurs. This was proven by several students who carried out entrepreneurial business in the form of online, offline, and home industry with various efforts and attitudes: having commitment and determination, having a sense of responsibility, being ambitious to look for opportunities, working hard spirit, having competitive spirit, maintaining change, being creative and innovative (Zimmerer, 2002: 74). Therefore, this study recommended to develop creative formal education and training programs to succeed in fostering students’ entrepreneurial knowledge and attitudes.

Students’ emotional intelligence mediated the significant effect of entrepreneurship learning model on students’ intentions in entrepreneurship. The learning model had a significant effect on the emotional intelligence variable; while the emotional intelligence variable had a significant effect on the student’s entrepreneurial interest variable. So the students’ emotional intelligence variable was partially mediated. Students’ emotional intelligence which aimed to recognize their own emotions and others’ emotion could escalate students’ entrepreneurial intentions in the University of Madura. These results are in line with a research by Korhenen et al. (2016) that students’ academic intelligence do not eventually determine entrepreneurial intentions. Those who have moderate grades generally posses optimal emotional intelligence that can lead them to be more creative and innovative entrepreneurs. The students with higher emotional intelligence can be more confident to be entrepreneurs. Such students are described more skillfull to do whatever they perceive right and success. Moreover, students with emotional intelligence are able to motivate themselves and endure frustration, control impulses and not exaggerate pleasures, regulate moods, keep stress free, impair to think, empathize and always pray. In brief, students who take entrepreneurship course with emotional intelligence will be more potential to achieve success rather than ones who have high intellectual intelligent, but have less emotional intelligent.

VII. FINDINGS

As the analysis results and discussion, this study indicated several findings. First, the variable of learning model for entrepreneurship subjects had a significant effect on students' entrepreneurial intentions. The appropriate learning model for sustainable entrepreneurship courses include four stages: 1) developing an entrepreneurial mindset to students; 2) business introduction; 3) start-up business; and 4) business development. This study also found mediating variables, such as: personal character, independent attitude, and emotional intelligence that mediated the significant effect of entrepreneurship learning model on students’ entrepreneurial interest. The result of mediating variables with the highest coefficient value was the independent attitude variable.

This study confirmed the implementation of Theory of Planned Behavior which consisted of attitudes towards behavior, subjective norms, and perceptions on behavior control. Attitudes towards behavior are developed and modified on independent attitudes. In this case, students will work in accordance with their own attitude towards their independent behavior for living. Otherwise, subjective norms are developed and modified into personal characters. In this section, personal character is identical to subjective norms by observing students’ actions in generating their development awareness on surrounding community and social pressure. Meanwhile, the perceptions on behavioral control are developed and modified into emotional intelligence of which students understand their behavior indicating their ability of self-control based on emotional intelligence. Therefore, the Theory of Planned Behavior on this study undergoes a modification of which Madurese students’ attitudes toward behavior become their independent attitudes, their subjective norms become personal characters, and their perceptions of behavior control are modified into emotional intelligence.

VIII. CONCLUSION

This study investigated the application of learning model for entrepreneurship course to generate students’ entrepreneurial
intentions in Madura. This concluded that the learning model for entrepreneurship should be improved subsequently. The lecture model needs to be removed since students are not interested in the classroom. They get bored because there are no active interactions between informers (lecturers) and recipients of information (students). Otherwise, attractive learning models and entrepreneurial practices are required to foster students’ learning motivation and enthusiasm in entrepreneurship.

Overall, this study found the significant relationship between all variables. This can be concluded that the learning model for entrepreneurship courses can create Madurese students’ entrepreneurial interest in the university. Likewise, the mediating variables consisting of personal character, independent attitude, and emotional intelligence mediated the significant effect of the entrepreneurship learning model on students’ entrepreneurial intention.

REFERENCES


AUTHORS

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Tuberculosis control in Sri Lanka; Challenges and measures to overcome

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Abstract

Introduction and aims
Tuberculosis (TB) is regarded as the global leading cause of death among the infectious diseases. Sri Lanka is a country with low burden for Tuberculosis. Annually there is a case gap of 4,000 is found between WHO estimation and the actual detection in Sri Lanka. This research was done to explore the challenges on TB control in Sri Lanka and discuss the measures to overcome these barriers.

Methods
PubMed and Embase databases, National Programme for Tuberculosis Control and Chest Disease(NPTCCD) and Ministry of Health Sri Lanka websites were searched using subject headings and keywords. Unpublished data from NPTCCD were obtained with permission. Articles and content of grey-literature were screened for the relevance and quality.

Results
Following challenges were identified; Reduction of case findings, Inadequacy of human resources, Underutilization of the existing diagnostic facilities, Reduction of OPD referral, Obstacles for case finding with Covid 19, Reduction of contact tracing, Stigma, Reduction of social support.

Conclusion
There are many gaps and challenges in Tuberculosis control. They can be overcome by maximum utilization of available diagnostic facilities, increasing awareness among health care workers on available facilities and increasing OPD referrals to chest clinics.

Index Terms: Tuberculosis, Control, Challenges, Sri Lanka

I. INTRODUCTION

Tuberculosis (TB) is regarded as the global leading cause of death among the infectious diseases(1). It is caused by the organism Mycobacterium tuberculosis. In 2018, estimated 10.0 million (range 9.0-11.1 million) were diagnosed with TB(2). Sri Lanka is a country with low burden for Tuberculosis. Actual incidence of Tuberculosis in Sri Lanka is 37.8 cases per 100,000 population which is second lowest in the region next to Maldives. Nearly 8000-9000 patients of TB are detected each year(3). According to the WHO, estimated incidence of Tuberculosis in Sri Lanka is 14,000 (64 per 100,000 population) (4). This create a case gap of 4,000 between estimated and the actual detection(3). Case fatality ratio of Tuberculosis in Sri Lanka in 2018 was 6%(4). The incidence of TB in Sri Lanka remains static over the past four years.
National Programme for Tuberculosis and Chest Disease (NPTCCD) is the national level organization responsible for TB and Respiratory disease control activities in the entire country. Development of policies/guidelines in line with global standards and provision of technical guidance for the district are some of the activities of NPTCCD(5).

There are 26 district chest clinics (DCC), 108 branch clinics, 180 microscopy centres available to diagnose Tuberculosis in Sri Lanka (6). District Tuberculosis Control Officer (DTCO) is responsible for coordinating all the TB control activities at the district level and administrative head of the DCC. Consultant Respiratory Physician is involved with the diagnosis and management of Tuberculosis. Consultant Respiratory Physician is covering up duties in all most all the districts except Mullaitivu.

Consultant Microbiologist is responsible to conducting Culture and Gene Xpert investigations. Sputum microscopy is conducted by the Public Health Laboratory Technicians(PHLT) or TB Assistants attached to the district chest clinics. Xpert MTB facility was introduced to Sri Lanka in 2018 and there are 31 Gene Xpert machines available in Sri Lanka. This facility helps in rapid diagnosis of TB and it does not require an expert training. This facility is available at microbiology labs in Sri Lanka under the guidance of Consultant Microbiologists.

This research was done to explore the gaps and challenges on TB control in Sri Lanka and to identify the way forward to overcome barriers in relation to the Sri Lankan healthcare system.

II. METHODS
A comprehensive literature search was done in PubMed and Embase databases, NPTCCD and Ministry of Health Sri Lanka websites. The related subject headings (MeSH in PubMed) as well as related keywords were used in the search strategy. Unpublished data from NPTCCD were obtained with permission. The articles and content were screened by the investigator for the eligibility (relevance and quality).

III. RESULTS
Following are the identified challenges for tuberculosis control activities.

1. Reduction of case detection
   There is a reduction of TB incidence from year 2018 to 2019. In addition to the case gap of 4000 cases per year, there is a reduction of case finding. (Table1)

   The estimated pediatric Tuberculosis TB cases should be 5% from the total Tuberculosis case detection. Currently it is 2.8% from the total Tuberculosis cases. In 2019, estimated pediatric Tuberculosis TB cases was 391 (which is 5% from the total TB cases) and the actual number is 234. There is a decline in Pediatric Tuberculosis case detection from 2018 to 2019. (Table2)
Table 1: Distribution of Tuberculosis case detection over 2006-2019

<table>
<thead>
<tr>
<th>Year</th>
<th>New Cases</th>
<th>Relapse</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>8283</td>
<td>65</td>
</tr>
<tr>
<td>2007</td>
<td>8497</td>
<td>65</td>
</tr>
<tr>
<td>2008</td>
<td>8996</td>
<td>64</td>
</tr>
<tr>
<td>2009</td>
<td>9118</td>
<td>65</td>
</tr>
<tr>
<td>2010</td>
<td>9228</td>
<td>65</td>
</tr>
<tr>
<td>2011</td>
<td>9508</td>
<td>65</td>
</tr>
<tr>
<td>2012</td>
<td>8507</td>
<td>65</td>
</tr>
<tr>
<td>2013</td>
<td>8767</td>
<td>65</td>
</tr>
<tr>
<td>2014</td>
<td>8692</td>
<td>65</td>
</tr>
<tr>
<td>2015</td>
<td>8990</td>
<td>65</td>
</tr>
<tr>
<td>2016</td>
<td>8332</td>
<td>65</td>
</tr>
<tr>
<td>2017</td>
<td>8013</td>
<td>65</td>
</tr>
<tr>
<td>2018</td>
<td>8258</td>
<td>64</td>
</tr>
<tr>
<td>2019</td>
<td>7812</td>
<td>64</td>
</tr>
</tbody>
</table>

Source: National Programme for Tuberculosis Control & Chest Diseases

Table 2. Differences in Actual and Estimated Pediatric New Tuberculosis cases from 2010 to 2019 period

<table>
<thead>
<tr>
<th>Year</th>
<th>New Cases</th>
<th>Relapse</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>392</td>
<td>456</td>
</tr>
<tr>
<td>2011</td>
<td>354</td>
<td>475</td>
</tr>
<tr>
<td>2012</td>
<td>309</td>
<td>425</td>
</tr>
<tr>
<td>2013</td>
<td>307</td>
<td>438</td>
</tr>
<tr>
<td>2014</td>
<td>313</td>
<td>435</td>
</tr>
<tr>
<td>2015</td>
<td>307</td>
<td>450</td>
</tr>
<tr>
<td>2016</td>
<td>263</td>
<td>417</td>
</tr>
<tr>
<td>2017</td>
<td>244</td>
<td>401</td>
</tr>
<tr>
<td>2018</td>
<td>268</td>
<td>413</td>
</tr>
<tr>
<td>2019</td>
<td>234</td>
<td>391</td>
</tr>
</tbody>
</table>

Source: National Programme for Tuberculosis Control & Chest Diseases

2. Inadequacy of human resources
This is another challenge when planning and monitoring activities in the national level, implementation of the policies, providing technical support to the district level, supervision of the DCC staff, supervision of the laboratory activities at the national level. Further at national level there is a lack of Consultant Community Physicians and Consultant Microbiologists and at district level, there is a lack of Medical Officers in the DCC, Public Health Inspectors(PHI), and PHLTs etc.

3. Underutilization of the existing diagnostic facilities
Though the Gene Xpert facility is available in Sri Lanka since 2018, still some of the General Physicians, Pediatricians and OPD Medical Officers are unaware the available locations of this facility, which leads to underutilization of this service. There were 17 digital X Ray machines available to take Chest X Rays from Tuberculosis patients. Advantage of digital X Ray over films are quality of the image, cost saving, easy to use and decreased radiation exposure(7). Underutilization of Digital X-Ray machines occur in some areas due to absence of a permanent radiographer to the chest clinics. In some chest clinics, X Rays are being taken once a week due to absence of radiographer and it leads to underutilization of this facility. In some centers though the digital X Ray machine is provided under global fund, there is delaying in developing the X Ray room and other infrastructure facilities utilizing provincial funds.

4. Reduction of OPD referral
In a Hospital OPD on average 2% of the OPD patients present with respiratory symptoms(8). If the symptoms are suggestive of TB, OPD doctor has to refer them to hospital microscopy center or nearest chest clinic with a sputum sample. Details of those patients have to be documented in the presumptive TB register which should be maintained at the hospital OPD. It was noticed that presumptive TB register is not updated compatible to the hospital OPD attendance. This leads to inability to trace the patients who have been referred from OPD but not reached to chest clinic. Further it will be not possible to get number of chest clinic referrals done from OPD unless it was updated properly. In addition, OPD Medical Officers are not allowed to order Chest X-Rays at the OPD. Therefore patients have to be admitted to get Chest X-Rays or it has to be taken from the private sector.

5. Obstacles for case finding with Covid 19
Covid 19 pandemic has affected the case detection of Tuberculosis. The island wide lockdown imposed in Sri Lanka from 20th of March 2020 it was lifted on 11th of May(9). During this 52 days there was a clear reduction of identification of Tuberculosis cases.

Table 3: Distribution of Tuberculosis case detection in January to August 2020

<table>
<thead>
<tr>
<th>Month</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>727</td>
</tr>
<tr>
<td>February</td>
<td>713</td>
</tr>
<tr>
<td>March</td>
<td>549</td>
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<tr>
<td>April</td>
<td>344</td>
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<td>May</td>
<td>404</td>
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<tr>
<td>June</td>
<td>633</td>
</tr>
<tr>
<td>July</td>
<td>661</td>
</tr>
<tr>
<td>August</td>
<td>665</td>
</tr>
</tbody>
</table>

Source: National Programme for Tuberculosis Control & Chest Diseases

6. Reduction of contact tracing
In order to prevention and early Identification TB cases, all TB contacts should be identified and screening should be carried out. Highest percentage (43%) of TB cases was found in the Western Province of Sri Lanka in 2019 of which Colombo district had the highest number of 2024 cases and it is 23.9% of all cases. Large number of people are internally migrated to the Western province due to employment and education.
purposes. There is lot of urban slums in in the city and poor socioeconomic living conditions in Western province facilitate the increase TB cases. Total number of contacts in Colombo district in 2019 was 5921 and of them 3051 were screened. Therefore, contacts screened percentage was 51.53% in Colombo distrcit. Gampaha district had 1070 cases in 2019 and there were 2975 of total contacts. Out of that 1634 of contacts were examined and contacts screened percentage was 54.9%. In Sri Lanka highest number of cases are found in these two districts and contact screening should be improved to when reaching the targets.

7. Stigma
Since TB is a disease with stigma, case identification is a challenge to health care workers in all the districts. People usually are scared to know that they are having TB. Sometimes TB patients experienced family disruption, breaking marriages, losing jobs following diagnosis. Therefore, people tend to hide the disease condition and not reveal true facts of having TB. This affects largely to contact tracing.

8. Reduction of Social support
Once diagnosed, TB patients get a monthly allowance until completion of 6 months treatments. This allowance vary from province to province, from Rs.450 to Rs.5000 rupees per month. Providing adequate monthly allowance for TB patients is necessary to get a good outcome. Reduction of social support is another challenge when controlling TB.

9. Implementation of ePMIS system
National Programme for Tuberculosis Control and Chest Disease (NPTCCD) has implemented electronic Patient Management Information System (ePIMS) since 2019 by digitalizing the existing database greatly improving and streamlining data flow from districts to central level. The ePIMS consist of patient based module with all the information relevant to the patients management, lab module to enter laboratory data (microscopy, Gene Xpert and biochemistry results), MOH module to send and receive notifications and drug module to enter data on anti TB drugs. Although ePIMS is nationwide, there is a slow progress in adapting to the electronic information system by the health care workers at the District Chest Clinics when entering data. Patient registration Module is done in all districts and is of satisfactory level. However, entering follow up data, sputum conversion and outcome data are not at a satisfactory level.

IV. DISCUSSION

Filling the cadre as well as arrange regular training to staff is equal importance when reaching targets. PHLTs should be offered a regular training to avoid inaccurate findings at sputum microscopy tests. Quality assurance of the sputum samples should be carried out regularly to check the quality.

In some hospitals distance between microscopy unit and OPD is too far. Therefore, patients might loss way between OPD and microscopy center. If the hospital OPD is not maintaining or not updating Presumptive TB register properly it leads to losings patients contact information of those having respiratory symptoms. There might be undiagnosed TB patients among them which could spread the disease in the community. To overcome this there should be adequate referrals from OPD to microscopy center and they should maintain Presumptive TB register properly. Awareness among general practitioners, physicians, and pediatricians should be improved to sending adequate referrals to these centers.

Due to similar symptoms between Tuberculosis and Covid 19, it can affect the case findings of TB. The fear of public to present to the health care setting with cough, due to fear of stigma due to Covid, fear to be stay at a quarantine center for 2 weeks, separation from family members during that period were some
reasons leading to resistance of the public to reveal their symptoms unless they develop breathlessness. There was very minimal personal protective equipment for the health care workers at the initial stage of Covid. Due to that health workers were reluctant to collect sputum samples from patients and examine for TB. The difficulties in finding transport facilities and financial problems occurred during that period has an effect on reduction of case identification. However, once the lockdown period was over sample collection and case identification became gradually increased. With the persistence of Covid, until developing a effective vaccine, this challenge will not be overcome.

Lack of continuous training and commitment among health care workers, networking and hardware maintenance issues are main reasons for not fully utilizing the ePIMS system. Once it properly implemented, real time data can be visualized without any delay and could be able to plan, monitor and disseminate the data efficiently.

V. CONCLUSION

There is a nearly 4000 case gap found between estimated and actual case identification. Difficulty to identify the pediatric cases, underutilizing of existing diagnostic facilities, poor contact tracing, stigma, lack of social support, lack of human resources are identified as challenges. Maximum utilization of available diagnostic facilities, increase awareness among health care workers on available facilities, increase OPD referrals to chest clinics and hospital microscopy centers are recommended to overcome these challenges.

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Casson Fluid Flow Effects on MHD Unsteady Heat And Mass Transfer Free Convective Past An Infinite Vertical Plate

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Abstract
The study was carried out numerically to study to investigate casson fluid effects on magneto-hydrodynamics (MHD) unsteady heat and mass transfer free convective past an infinite vertical plate. Appropriate dimensional quantities were applied to change the dimensional governing coupled non-linear partial differential equations to non-dimensional form. Numerical solution of the dimensionless governing coupled boundary layer partial differential equations were obtained using finite element method (FEM). The expressions of velocity, temperature, concentration, skin friction, Nusselt number as well as Sherwood number have been obtained and discussed using line graph. From the result, it was revealed that, increase of porosity parameter $K$, ratio of mass transfer parameter $N$, and Eckert number $Ec$ enhances the velocity profile and reverse is the case with the with increase of Magnetic parameter $M$, Casson fluid parameter $\beta$ and Prandtl number $Pr$. Similarly all the above parameters provided the same effects on temperature profile except on casson fluid parameters $\beta$ which provided an opposite effects. Skin friction at $y = 0$ and $y = 1$ gets enhanced with increase in casson fluid parameter $\beta$ and gets reduced with increase in porosity parameter $K$. Increase in casson fluid parameter $\beta$ decreases Nusselt number at $y = 0$ and it gets enlarged by increasing the value of Eckert number $Ec$. At $y = 1$ Nusselt number gets enhanced with increase of casson fluid parameter $\beta$ and gets reduced with increase in of Eckert number $Ec$. Sherwood number at $y = 0$ and $y=1$ has no any significant by increasing casson fluid parameter and Schmidt number $Sc$.

1 Introduction

Normally Casson fluid displays yield stress. Casson is known with a shear thinning liquid which is believed to have an infinite viscosity at zero rate of shear. A yield stress below which no flow occurs, and a zero viscosity at an infinite rate of shear, i.e., if a shear stress less than the yield stress is applied to the fluid, it behaves like a solid, whereas if a shear stress greater than yield stress is applied, it starts to move (Ananda, Reddy and Janardhan 2017). A Casson fluid which is normally exemplified as Honey, human blood, jelly, sauces and so on are very important. Casson fluids are very important fluid used in various fields like biological, chemical, medical, metallurgical and engineering. Also casson fluid is applied in food processing and drilling operation. Additionally, Casson fluid is applied in pharmaceutical products, coal in water, china clay, paints, synthetic lubricants, and biological fluids such as synovial fluids, sewage sludge, jelly, tomato sauce, honey, soup, and blood due to its contents such as plasma, fibrinogen, and protein (Jawad, Azizah and Zurni 2016). Many researchers carried out their research work in industrial environment on the on the flow of the Casson fluid of the effects of various parameters.

Sheikh, Parth, Sarder and Shidkar (2019) studied mass and heat transfer behavior of viscous dissipative chemically reacted casson fluid. Which is flowing with the impact of suction, thermal conductivity and variable viscosity is being discussed explicitly in this paper. The investigation of analytical analysis of unsteady MHD boundary layer flow of Casson fluid past an oscillating vertical porous surface subjecting to Newtonian heating using Laplace transform technique was carried out by Manjula and Chandra (2018). Additionally, Kartini, Syafriina and Zahir (2018) Analyzed Casson fluid flow with variable viscosity in porous media over a heated...
stretching sheet. Rama, Prof. Moreover, Viswanatha, and Balakrishna (2018) studied An Unsteady MHD free convection flow of casson fluid past an exponentially accelerated infinite vertical plate through porous media in the presence of thermal radiation and heat source or sink. The analyses of Couette flow of a Casson fluid in an inclined composite duct comprising of porous and fluid layers of different thickness was investigated by Manoj, Sreenadh, Gopi Krishna and Srinivas (2019). Veena, Vinuta and Pravin (2017) investigated two-dimensional flow of non-Newtonian MHD flow of Casson fluid heat transfer with PST & PHF was considered, using Navier Stoke’s Equations of Motion the momentum and energy equations of Casson fluid were derived

Imran, Sharidan and Ilyas (2016) studied combined effects of slip condition and Newtonian heating on MHD free convectional flow of Casson fluid over a nonlinearly stretching sheet in saturated porous medium. Also Kamran, Hussain, Sagheer and Akmal (2017) studied the Casson nanofluid past horizontal stretching surface with magnetic effect and Joule heating under the consideration of Slip and thermal convective boundary conditions. They discovered that, increase Casson fluid parameter the declines the velocity profile and rises temperature profile. Ananda et., al (2017) studied the combined effects of chemical reaction, radiation, Dufour and Soret effects on Casson MHD fluid flow over a vertical plate with heat source / sink and concluded that velocity falls down with the increase of Casson parameter and temperature is decreased when thermal radiation is increased. The study of the effects of non-Darcy MHD flow of a Casson fluid over a nonlinearly stretching sheet in a porous medium was conducted by Bhim, Rachid and Hasan (2019). They revealed that increase in the value of the Casson parameter decreases velocity and increases skin friction. Hamzeh (2018) studied the effect of MHD free convective boundary layer flow about a solid sphere in a micropolar Casson fluid. They reported that increasing in Casson parameter increases both values of the local Nusselt number and angular velocity profile. While the skin friction coefficient, temperature and velocity profiles decrease. Hasan and Zillur (2019) investigated the flow of Casson fluid and heat transfer over a permeable vertical stretching surface considering the effects of magnetic field and thermal radiation. They revealed that increasing the value of Casson parameter leads to the increase of temperature and decrease in velocity profile. Pramanik (2014) investigated the boundary layer flow of a non-Newtonian fluid accompanied by heat transfer toward an exponentially stretching surface in presence of suction or blowing at the surface. He concluded that Momentum boundary layer thickness decreases with increasing Casson parameter.

The analysis of (MHD) flow of a Casson fluid over an infinite vertical oscillating plate embedded in a porous medium was carried out by Abid, Mohd, Ilyas and Razman (2017). They revealed that fluid flow can be controlled by the increasing the values of Prandtl number as well as by the increasing of Casson parameter. Hassan, Sajjad, Rabia, Amna and Shamila (2017) investigated the mixed convection radiative heat transfer of electrically conducting Casson fluids. The fluid flows past a permeable stretching sheet lying in the porous medium. They revealed that, the velocity reduces in magnitude with increase in Casson parameter β. Furthermore, Renuka, Ganga, Kalaivanan, and Abdul Hakeem, (2017) investigated Ohmic dissipation effects of Casson fluid in the presence of inclined magnetic field over a stretching sheet with slip and thermal radiation. They concluded that the velocity of the non-Newtonian fluid reduces with the increasing aligned angle of magnetic field, Casson parameter, velocity slip parameter and magnetic parameter. The investigation of the impact of induced magnetic field on Casson fluid flow past a vertical plate was done by Parandhama, Rajua, and Changal (2019). They revealed that, the velocity falls down with an increase of casson fluid parameter β. Moreover, Hymavathi and Sridhar (2016) investigated the effect of mass transfer of a MHD Casson fluid over a porous stretching sheet in presence of chemical reaction using Keller box method. They discovered that increase in Casson parameter β increases the velocity profile, while reverse is the case for temperature and concentration profile.

Prabakhar (2016) studied the effects of mass transfer on an unsteady free convection flow of viscous dissipative fluid past an infinite vertical porous plate under the influence of a uniform magnetic field applied normal to the plate. The present research work
tends to adopt and extend Prabhakar model through incorporating the casson fluid parameter on magneto-hydrodynamics (MHD) unsteady heat and mass transfer free convective past an infinite vertical plate. The study employed finite element method (FEM) to find numerical solution of governing coupled non-linear boundary layer partial differential equations. The expressions of velocity, temperature, concentration, skin friction, Nusselt number as well as Sherwood number have been obtained and discussed using line graph.

2 Formulation of the Problem

Consider an unsteady free convection flow of an incompressible electrically conducting viscous dissipative fluid past an infinite vertical porous plate. Let the x* -axis be chosen along the plate in the vertically upward direction and the y* axis is chosen normal to the plate. A uniform magnetic field of intensity H₀ is applied transversely to the plate. The induced magnetic field is neglected as the magnetic Reynolds number of the flow is taken to be very small. Initially, the temperature of the plate T₀* and the fluid T₀w* are assumed to be the same. The concentration of species at the plate C₀w* and C₀* are assumed to be the same. At time t* > 0, the plate temperature is changed to T₀*, which is then maintained constant, causing convection currents to flow near the plate and mass is supplied at a constant rate to the plate. Under these conditions the flow variables are functions of time y* and t* alone. The problem is governed by the following equations:

\[
\frac{\partial \bar{u}^*}{\partial t^*} = \left( \frac{1}{1 + \beta} \right) \frac{\partial^2 \bar{u}^*}{\partial y^*^2} + g \beta (T^* - T₀^*) + g \beta^* \left( C^* - C₀^* \right) - \frac{\sigma \mu e^2 H_0^2 \bar{u}^*}{\rho} - \frac{v \bar{u}^*}{K^*}
\]

(1)

\[
\rho C_p \frac{\partial \bar{T}^*}{\partial t^*} = k \frac{\partial^2 \bar{T}^*}{\partial y^*^2} + \mu \left[ \frac{\partial \bar{u}^*}{\partial y^*} \right]^2
\]

(2)

\[
\frac{\partial \bar{C}^*}{\partial t^*} = D \frac{\partial^2 \bar{C}^*}{\partial y^*^2}
\]

(3)

The corresponding initial and boundary conditions are:

\[
\begin{align*}
&\left[t^* \leq 0, \quad \bar{u}^* = 0, \quad T^* = T_0^*, \quad C^* = C_0^* \text{ for all } y^* \right] \\
&\left[t^* > 0, \quad \bar{u}^* = 0, \quad T^* = T_0^*, \quad C^* = C_0^* \text{ at } y^* = 0 \right] \\
&\left[u^* = 0, T^* \rightarrow T_0^*, \quad C^* \rightarrow C_0^* \text{ as } y^* = \alpha \right]
\end{align*}
\]

(4)

We now introduce the following non-dimensional quantities into the basic equations and initial and boundary conditions in order to make them dimensionless.
\[ U_0 = (vg \beta \Delta T)^{\frac{1}{2}} \quad L = \left( \frac{g \beta \Delta T}{v^2} \right)^{\frac{1}{2}} \quad T = \left( \frac{g \beta \Delta T}{v^2} \right)^{\frac{1}{2}} \]

\[ \Delta T = T^* - T_w^* \quad \text{On the} \quad t = \frac{y}{\sqrt{T_R}} , \quad y = \frac{y^*}{L} \]

\[ u^* = \frac{u}{U_0} , \quad K = \frac{K^*}{\sqrt{T_R}} , \quad \Theta = \frac{T^* - T_0}{T_w^* - T_0} , \quad \phi = \frac{C^* - C_0}{C_w^* - C_0} \]

\[ \text{Pr} = \frac{\mu C_p}{k} , \quad \text{Sc} = \frac{v}{D_m} , \quad Ec = \frac{U_0^2}{C_p \Delta T} , \quad \beta = \frac{(C_w^* - C_0^*)}{(C_w^* - C_0)} \]

\[ N = \beta^*(C_w^* - C_0^*) \quad M = \frac{\sigma \mu_0^2 H_0^2 T_R}{\rho} \]

substitution of equations (5) into (1) - (4) the following governing equations in non-dimensional form are obtained.

\[ \frac{\partial u}{\partial t} = \left( \frac{1}{1 + \beta} \right) \frac{\partial^2 u}{\partial y^2} + Gr \theta + N \phi - (M + \frac{1}{K})u \quad (6) \]

\[ Pr \frac{\partial \theta}{\partial t} = \frac{\partial^2 \theta}{\partial y^2} + Ec \left( \frac{\partial u}{\partial y} \right)^2 \quad (7) \]

\[ Sc \frac{\partial \phi}{\partial t} = \frac{\partial^2 \phi}{\partial y^2} \quad (8) \]

The corresponding initial and boundary conditions are

\[ t \leq 0 , \quad u = 0 , \quad \Theta = 0 , \quad \phi = 0 \quad \text{for all} \quad y \]

\[ \text{For} \quad t > 0 : \quad u = 0 , \quad \Theta = 1 , \quad \phi = 0 \quad \text{at} \quad y = 0 \]

\[ u = 0 , \quad \Theta = 0 , \quad \phi = 0 \quad \text{at} \quad y = \alpha \quad (9) \]

3 Method of the Solution

Equations (6) – (8) are coupled non-linear system of partial differential equations and finite element method (Galerkin approach) would be used to solve them under the boundary conditions (9).

By applying Galerkin finite element method for equation (6) over the element \( \gamma \), \( y_i \leq y \leq y_j \) is

\[ \int_{y_i}^{y_j} N^T \left[ \left( \frac{1}{1 + \beta} \right) \frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial t} - u(M + \frac{1}{K}) + N \phi + \Theta \right] dy = 0 \quad (10) \]

Equation (10) is shortened as:

\[ \int_{y_i}^{y_j} N^T \left[ M \frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial t} - M_i u + P \right] dy = 0 \quad (11) \]
Applying integration by part to equation (10) yield:

\[
[M_2N^T \frac{\partial u}{\partial t}]_i^j - \int_{y_i}^{y_j} \frac{\partial N^T}{\partial y} \frac{\partial u}{\partial t} dy - \int_{y_i}^{y_j} \frac{\partial N^T}{\partial t} \frac{\partial u}{\partial y} dy - M_1 \int_{y_i}^{y_j} N^T u dy + P \int_{y_i}^{y_j} N^T dy = 0
\]

Ignoring the first term of equation (12) we have:

\[
\int_{y_i}^{y_j} \frac{\partial N^T}{\partial y} \frac{\partial u}{\partial t} dy + \int_{y_i}^{y_j} \frac{\partial N^T}{\partial t} \frac{\partial u}{\partial y} dy + M_1 \int_{y_i}^{y_j} N^T u dy - P \int_{y_i}^{y_j} N^T dy = 0
\]

(12)

Let \( u^{(e)} = u_j N_i + u_i N_j \) be a linear piecewise approximation solution over the two nodal element \( e \), \((y_i \leq y \leq y_j)\) where \( u^{(e)} = [u_i, u_j] \), \( N = [N_i, N_j] \) also \( u_i \) and \( u_j \) are the velocity component at the \( i^{th} \) and \( j^{th} \) nodes of the typical element \( e \) \((y_i \leq y \leq y_j)\) moreover, \( N_i \) and \( N_j \) are called basis (or shape) functions defined as follows:

\[
N_i = \frac{y - y_i}{y_j - y_i}, \quad N_j = \frac{y_j - y}{y_j - y_i}
\]

Hence equation (13) after simplifying becomes:

\[
M_2 \left[ \begin{array}{c}
\int_{y_i}^{y_j} N_i N_j \left[ \begin{array}{c}
u_i \\
u_j
\end{array} \right] dy \\
\int_{y_i}^{y_j} N_i N_j \left[ \begin{array}{c}
u_i \\
u_j
\end{array} \right] dy + M_1 \int_{y_i}^{y_j} N_i N_j \left[ \begin{array}{c}
u_i \\
u_j
\end{array} \right] dy
\end{array} \right] = 0
\]

(13)

Also simplifying equation (14) above we have:

\[
\frac{M_2}{l^2} \left[ \begin{array}{c}
1 & -1 \\
-1 & 2
\end{array} \right] \left[ \begin{array}{c}
u_{i-1} \\
u_i
\end{array} \right] + \frac{M_2}{l} \left[ \begin{array}{c}
2 & 1 \\
1 & 2
\end{array} \right] \left[ \begin{array}{c}
u_i \\
u_{i+1}
\end{array} \right] + \frac{M_1}{6} \left[ \begin{array}{c}
2 & 1 \\
1 & 2
\end{array} \right] \left[ \begin{array}{c}
u_i \\
u_{i+1}
\end{array} \right] - \frac{P}{2} = 0
\]

(14)

Where \( l = y_j - y_i = h \) and prime and dot denotes differentiation with respect to \( y \) and \( t \) respectively. Assembling the equations for the two consecutive elements \( y_{i-1} \leq y \leq y_i \) and \( y_i \leq y \leq y_{i+1} \) the following is obtained:

\[
\frac{M_2}{l^2} \left[ \begin{array}{c}
1 & -1 \\
-1 & 2
\end{array} \right] \left[ \begin{array}{c}
u_{i-1} \\
u_i
\end{array} \right] + \frac{M_2}{l} \left[ \begin{array}{c}
2 & 1 \\
1 & 2
\end{array} \right] \left[ \begin{array}{c}
u_i \\
u_{i+1}
\end{array} \right] + \frac{M_1}{6} \left[ \begin{array}{c}
2 & 1 \\
1 & 2
\end{array} \right] \left[ \begin{array}{c}
u_i \\
u_{i+1}
\end{array} \right] - \frac{P}{2} = 0
\]

(16)

Now if we consider the row corresponding to the node \( i \) to zero with \( l = h \), from equation (16) the difference schemes reads:

\[
\frac{M_2}{h^2} (-u_{i-1} + 2u_i - u_{i+1}) + \frac{1}{6} (u_{i-1} + 4u_i + u_{i+1}) M_1 (u_{i+1} + 4u_i + u_{i+1}) = P
\]

(17)

Using the trapezoidal rule on (17), the following system of equations in Crank-Nicolson method is obtained as:

\[
A_1 u_{i+1}^{n+1} + A_2 u_i^{n+1} + A_3 u_{i+1}^{n+1} = A_4 u_i^n + A_5 u_i^n + A_6 u_{i+1}^{n} + P
\]

(18)

Likewise, by solving (7) and (8) using the same method we have:

\[
B_1 u_{i+1}^{n+1} + B_2 u_i^{n+1} + B_3 u_{i+1}^{n+1} = B_4 u_{i+1}^n + B_5 u_i^n + B_6 u_{i+1}^n + Q
\]

(19)
\[ C_1 \phi_{i-1}^{n+1} + C_2 \phi_i^{n+1} + C_3 \phi_{i+1}^{n+1} = C_4 \phi_i^n + C_5 \phi_i^n + C_6 \phi_{i+1}^n \]  

(20)

Where:

\[ A_1 = 2 - 6M_2 r + rM_1 h^2, \quad A_2 = 8 + 12M_2 r + rM_1 h^2, \quad A_3 = 2 - 6M_2 r + rM_1 h^2 \]
\[ A_4 = 2 + 6M_2 r - rM_1 h^2, \quad A_5 = 8 - 12M_2 r - 4rrM_1 h^2, \quad A_6 = 2 + 6M_2 r - rM_1 h^2 \]
\[ B_1 = Pr - 3r, \quad B_2 = 4Pr + 6r, \quad B_3 = Pr - 3r \]
\[ B_4 = Pr + 3r, \quad B_5 = 4Pr - 6r, \quad B_6 = Pr + 3r \]
\[ C_1 = Pr - 3r, \quad C_2 = 4Pr + 6r, \quad C_3 = Pr - 3r \]
\[ C_4 = Pr + 3r, \quad C_5 = 4Pr + 6r, \quad C_6 = Pr + 3r \]

\[ P^* = 12rh^2(\theta_i^n + N\phi_i^n), \quad \text{and} \quad Q^* = 6rPr Ec \left[ \frac{\partial u}{\partial y} \right]^2 - R\theta \]

With \( r = \frac{k}{h^2} \) and \( h \) and \( k \) are the mesh size along y direction and time direction respectively. Index \( i \) denotes space and \( j \) denotes to the time. In equations (18), (19) and (20), taking \( i = 1(1)n \) and using the initials and boundary conditions (9), the following system of equations is obtained

\[ A_i X_i = B_i \quad i = 1(1)n \]

Where \( A_i \) matrices of are order \( n \) and \( X_i \) and \( B_i \) are column matrices having \( n \) components. The solution of the system of equations are obtained using Thomas algorithm for velocity, temperature and concentration. For various parameters the results are computed and presented graphically.

The skin friction, Nusselt number and Sherwood number are important physical parameters for this type boundary layers flow. With known values of velocity, temperature and concentration fields. The skin-friction at the plate is given by non-dimensional form:

\[ \tau = \left[ \frac{\partial u}{\partial y} \right]_{y=0.1} \quad (21) \]

The rate of heat transfer coefficient can be obtained in the terms of Nusselt number in non-dimensional form as

\[ N_u = -\left[ \frac{\partial \theta}{\partial y} \right]_{y=0.1} \quad (22) \]

The rate of mass transfer coefficient can be obtained in terms of Sherwood number in non-dimensional form given by

\[ S_h = -\left[ \frac{\partial \phi}{\partial y} \right]_{y=0.1} \quad (23) \]
4 Results and Discussion

We employed finite element method to solve equations (6) to (8) under the boundary conditions (9) in order to analyze the effects various parameters on flow field in the boundary layer region. We studied the effects Prandtl number $Pr$, casson fluid parameter $\beta$, Eckert number $Ec$, Schmidt number $Sc$, magnetic parameter $M$, porosity parameter $K$, Buoyancy effect parameter $r_b$, ratio of mass transformation ($N$) on fluid velocity, temperature and concentration and they were presented graphically. $Pr = 0.71$, $\beta = 1$, $Ec = 1$, $Sc = 0.2$, $M = 1$, $K = 1$ $N = 1$. The values above were adopted to be default parameters values under the present study. The velocity, temperature, and concentration profiles are presented in the following figures:

**Figure 1:** Effect of $M$ on velocity profile

**Figure 2:** Effect $Pr$ on velocity profile
Figure 3: Effect of K on velocity profile

Figure 1 gives the details about the control of magnetic parameter M on velocity profile. From that figure it is observed that the velocity profile begins to diminish at all point of the flow field by increasing the values of magnetic parameter M. This is true since magnetic parameter produce resistive force, which acts opposite direction to the fluid motion. Similarly figure 2 gives the details about the control Prandtl number Pr on fluid velocity profile. From that figure it is noticed that fluid velocity begins to diminish at all point of the flow field by increasing the values of Prandtl number Pr. While Figure 3 gives the details control about porosity parameter K on fluid velocity and it is also observed that fluid velocity begins to rise at all point of the flow field on increasing the values porosity parameter K.

Figure 4: Effect of N on velocity profile
Figure 4 and figure 5 reveals the influence of the ratio of mass transfer parameter \( N \) and Casson fluid parameter \( \beta \) on the fluid velocity respectively. It is observed that the fluid velocity gets intensified by increasing the values of both the ratio of mass transfer parameter \( N \) and casson fluid parameter \( \beta \). Figure 6 displays the effect of Eckert number \( Ec \) on the fluid velocity. It is observed that the velocity get significant enhancement by increasing the values of \( Ec \).
**Figure 7:** Effect of $M$ on temperature profile

**Figure 8:** Effect $Pr$ on temperature profile

**Figure 9:** Effect $\beta$ and on temperature profile
Figure 10: Effect $Ec$ on temperature profile

Figure 11: Effect of N on temperature profile

Figure 7 and 8; depict the influence of magnetic field parameter $M$ and Prandtl number Pr on fluid temperature respectively. From the both figures it is seen that, the fluid temperature diminishes by increasing the values of magnetic field parameter M and Prandtl number Pr respectively. While the opposite behavior is observed in figure 9 by increasing the value of casson fluid parameter $\beta$

Figure 10 and 11 displays the effect of Eckert number $Ec$ and ratio of mass transfer parameter N on fluid temperature respectively. It is observed that, from the both figures that temperature profile gets enlarged by increasing the values of Eckert number $Ec$ and ratio of mass transfer parameter N
Figure 12: Effect of Sc on temperature profile

Figure 12 depicts the influence of Schmidt number $Sc$ on temperature profile. From that figure it is seen that, the fluid temperature get reduced by increasing the values of magnetic field.

Figure 13(a) & 13(b): Effect $\beta$ and $K$ on Skin friction

Figure 14(a) & 14(b): effect $\beta$ and $Ec$ on Nusselt number
Figure 15(a) & 15(b): effect $\beta$ and $Sc$ on Sherwood number

Figure 13(a) and 13(b) displays the effect casson fluid parameter $\beta$ and porosity parameter $K$ on the fluid skin friction. It is seen that, increase in casson fluid parameter $\beta$ has enhancing effect on skin friction in both figure. But increase in porosity parameter $K$ has diminishing effect on skin friction in both figures. Figure 14(a) and 14(b) displays the effects of casson fluid parameter $\beta$ and Eckert number $Ec$ on Nusselt number. It is observed that in figure 14(a) increase in Eckert number magnifies the Nusselt number and reverse is the case with increase in casson fluid parameter $\beta$. In Figure 14(b) Nusselt decreases with increasing Eckert number $Ec$ and no significant effect is observed with increase of casson fluid parameter $\beta$. Figure 15(a) and 15(b) displays the effect of Schmidt number $Sc$ and casson fluid parameter $\beta$ on Sherwood number and it is clearly seen that both parameters have no any significant effect on it.

5 Conclusion

In this paper, we have investigated casson fluid effects on magneto-hydrodynamics (MHD) unsteady heat and mass transfer free convective past an infinite vertical plate. From the investigation, the following conclusions were drawn:

i. Increase of porosity parameter $K$, ratio of mass transfer parameter $N$, Eckert number $Ec$ enhances the velocity while reverse is the case with the increase of Magnetic parameter $M$, Casson fluid parameter $\beta$ and Prandtl number $Pr$.

ii. Similarly increase of porosity parameter $N$, Eckert number $Ec$ and Casson fluid parameter $\beta$ enhances the temperature profile and reverse is the case with the increase of Magnetic parameter $M$, and Prandtl number $Pr$.

iii. Concentration profile gets reduced by increasing the value Schmidt parameter $Sc$.

iv. Skin friction at $y = 0$ and $y = 1$ gets enhanced with increase in casson fluid parameter $\beta$ and gets reduced with increase in porosity parameter $K$.

v. Increase in casson fluid parameter $\beta$ decreases Nusselt number at $y = 0$ and it increases it by the increase of Eckert number $Ec$. At $y = 1$. Nusselt number magnifies with increase of casson fluid parameter $\beta$ and reduces with increase in of Eckert number $Ec$.

vi. casson fluid parameter $\beta$ and Schmidt number $Sc$ has no significant effects Sherwood number at both $y = 0$ and $y=1$.
References


Abstract- Micro sciences including nanotechnology are nm-scale investigations of extremely small objects. Specific and mixed age *Tribolium castaneum* and *Trogoderma granarium* have been reported from Faisalabad's grain market. The population had been acclimatized to the laboratory for each of the two species. Pupa of same age were obtained during insect rearing and in separately plastic containers for adult development (2 weeks) to increase diverse population. After isolation of plant products, biosynthesis of microparticles was performed similarly to standard operating procedure. Toxicity Bioassays were performed through three amounts (5, 10 and 15 %) of the extracts (for each of the basic plant oils and silver nanoparticles). Mortality results were reported after 24, 48 and 72 hours of medication. *Tribolium castaenium* had the highest mortality rate (15.10 %) and the lowest mortality rate (46.12 %). Silver nanoparticle gave highest mortality 57.91% against *Tribolium castaenium* and 39.39% against *Trogoderma granarium*. Repellency bioassay was conducted using a region choice approach followed by 75.39% (Silver nanoparticles), further results are confirmed by using Uv-visible and FTIR for their characterization. Under CRD statistical layout, data of all the bioassays is analyzed by factorial.

Index Terms- Micro sciences, nanotechnology, *Tribolium castaneum* and *Trogoderma granarium*, Mortality

I. INTRODUCTION

Nanosciences is an evolving and increasingly evolved process that can accept the elements of the fundamental that can recognize and advance the emerging type of material production that has one aspect. Nano meter is very small, Nano is a Greek word, which means ‘dwarf’ but in the technical term, it means 10⁻⁹. It can take hydrogen side by side equal width and size of nanometers, thousands of nanometers equal to the typical bacterium, and their diameter is equal to the redwood tree and human hair would be equal to 1nm in diameter. At this similar dimension, they display some physical properties such as, insulating materials to become conductors, and materials that would be inert can cause the explosive in nature. They are prepared from many nanostructured materials and devices. It has one dimension which is less than 100 nm[1]. It also used as a biomedical, optical and electronic field. The nanoparticle has been work very successfully in the field of medicine, environmental sciences and food processing[2]. Recently Nanoparticles can be produced by the physical, chemical and green synthesis method for a long time but their major role nowadays is in microbes’ biological system in the fabrication of metal Nanoparticles. Furthermore, the biosynthesis of nanoparticles is ecofriendly in nature because it can form without the use of harsh expensive chemicals. It also used as a highly conductor and semi-conductor, medical devices, sensor coating, catalytic agents and also used as a pesticide. Nanocarriers are aimed at reducing implementation quantity and slow pesticides transfer kinetics. [3]. Larvae and adults of this insect feed on damage grains [4] resulting up to 1-10% losses in different stored varieties of sorghum [5]. This insect pest has a presence in collected cereals can be contaminated the Grains as well as nutritional declines values[6] *T. castaenium* attacks the Germ section of the grains and reduces germination potential [7]. Unluckily, these synthetic insecticides are to be get accumulated in the environment because it should not be degradable, resulting in polluted surroundings [8]. This alarming situation has prompted the researchers to explore biodegradable and eco-friendly insecticides [9] which are crucial needs of the contemporary scenario. Due to the potential insecticidal properties botanical is the possible alternative source of pest control [9] In the past years, *T. castaenium* pest can be controlled by Polyethylene glycol and diatomaceous earth but garlic essential oil can be act as a reducing agent [10]. Noble metal nanoparticles such as silver are widely used in different fields due to its antibacterial and antioxidant properties. [11]. The efficacy of nano sized silver particles to control the pathogenic effect in plants [12].
Select and rear the insect for test culture

T.castaneum and T.granarium of various and varying age will be harvested through the grain market located in Faisalabad. The population for all two species is assimilated to the laboratory and has a supply potential of 1.5 kg in plastic containers (firstly decontaminate the store grains for T.granarium and store grain flour for T.castaneum; it can decontaminate through the oven for 30 minutes at 70 ° C (Lab Line Instrument Inc. Model No.3512-1) and cover it with muslin cloths. All insects will be sieved out from adults in goods after three days. Goal insects should have nests that can be processed commodities, are stored in jars and can be put in an ideal position (65±5±%al.H. and 30±2°C) and can be homogeneous to the F1 population as well (Hbib-ur-Rehman, 2018). After 3 days, bottles will be drained, then the bottles will be transferred into new boxes, the floor left behind will hold the eggs, the hatching time will be equivalent to 3 to 5 days [13].

Preparation of silver Nano-particles

Firstly we can prepare the silver Nano particle like this way, Take the leaves powder from R.communis, Jatropha curcus, Citrus paradise purchased from the local market. Deionized water used in all experiments, I took 10g of R. communis, Jatropha curcus and Citrus paradise extracts by using weight balance, which can be boiled in 100ml distill water in 250ml conical flask. Then this extract were cooled at room temperature, filter through Whatmans No. 1 Paper Filter. This filtrate was just an act of decreasing and stabilizing Silver nanoparticles synthesis operative. [14]Ammonium solution will be added to AgNO3 (solution accompanied by addition of 110ml extract of plant material) as described [14].

![Figure 1](Color changes after sometime)

The Silver Nanoparticles Biosynthesis

Using the green synthesis process, silver nanoparticles were synthesised. In this way silver nitrate were used as a precursor of silver metal cations which were reduced by ammonia solution (reducing agent). 1.6987mg (1mM) amount of silver nitrate was taken as a stock solution in 100 ml beaker, dissolve in 50ml deionized water. 5ml plant extract oil mixed in 50 ml distilled water and boiled at 100°C or 200rpm in hot plate for 1 hour. Add 10ml of plant extract (oil +Distill water) in silver nitrate solution drop wise in it. The total volume of the solution is 100ml by adding the deionized water. The solution was boiled at 80°C at 200rpm for 30 minutes and maintained the pH by adding the ammonia solution (0.5M), Different salt concentration (0.7-2 mM) were also be used. After adding ammonia solution Changed color of the solution. A Color transition from yellow to brown, was observed due to the reduction of Ag+ ion into Ag0 [14].
Figure 2. (Silver Dried nano-composites)

Table 3.2: Change in color of solution during formation of Silver Nitrate nanoparticles by using *Jatropha curcus*, *Citrus paradise* and *R. communis* plant extract

<table>
<thead>
<tr>
<th>Solution</th>
<th>Before Reduction</th>
<th>After Reduction</th>
<th>Color intensity</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Jatropha curcus</em></td>
<td>Dark Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6987mg (1mM)</td>
<td>Lite grey</td>
<td>Pale Yellow</td>
<td>+</td>
<td>Immediately</td>
</tr>
<tr>
<td><em>AgNO₃</em></td>
<td></td>
<td>Lite brown</td>
<td>++</td>
<td>After 7 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brown</td>
<td>+++</td>
<td>After 24 hours</td>
</tr>
<tr>
<td><em>Citrus paradise</em></td>
<td>Lite Yellow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6987mg (1mM)</td>
<td>Lite grey</td>
<td>Dark Yellow</td>
<td>+</td>
<td>Immediately</td>
</tr>
<tr>
<td><em>AgNO₃</em></td>
<td></td>
<td>Brown</td>
<td>++</td>
<td>After 7 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dark brownish</td>
<td>+++</td>
<td>After 24 hours</td>
</tr>
<tr>
<td><em>R. communis</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6987mg (1mM)</td>
<td>Lite grey</td>
<td>Yellow</td>
<td>+</td>
<td>Immediately</td>
</tr>
<tr>
<td><em>AgNO₃</em></td>
<td></td>
<td>Black brownish</td>
<td>++</td>
<td>After 7 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brown</td>
<td>+++</td>
<td>After 24 hours</td>
</tr>
</tbody>
</table>
CHARACTERIZATION OF NANOPARTICLES

We can determine the maximum production through absorption spectra of silver nanoparticle. We can observe the wavelength of SNP by using UV-visible spectrophotometer [15]; deionized Water continues to serve as a blank solution. Silver Nano particle optimum top point will be in air-dried form and it will be allowed to Characterized as described in Atomic-Force-Microscopy (Model-Nanosurf easyscan 2 AFM, Switzerland) [16].

Toxicity Bio Assay

Three plant extracts their concentration is (15, 10 and 5%) will be diluted in the stock solution by the use of four solvents. The concentration will be hands-on crushed grains, shaken for even distribution of concentration. It will allow to air dried and placed in small plastic jars. Both the insects, adults will be released in treated diet containing jars as described [17].

Repellency

Mean percent repellency was determining by using through a Favourable process. After the filter paper was cut in to the two halves, one half of each paper was treated with the extracts from the plants and acetone. After this som time passed the solution would be evaporated, then two halves were joined togetather and placed in a peteri dish. 20 Adults of Tribolium castanium and Trogoderma granarium were realeased in a center treated filter paper. The data was reported within 24, 48 and 72 hours, respectively [18].

Percentage of repels

\[
\text{Percentage of repels} = \frac{N_c - N_t}{N_c + N_t} \times 100
\]

III. STATISTICAL ANALYSIS

This Recorded data will be given through the Abott’s formula, for the calculation of percent corrected values (i.e. mortality), and statistical analysis (ANOVA) will be performed by using statistica-8.1 software. Treatments means will be compared by using TukeyHSD test at 5% signifi The mortality (%) was corrected by Abbot’s (1925) formula:

Corrected Mortality \[
\frac{(%M_c - (%M_0)}{100 - (%M_0)} \times 100
\]

Where, Mo = Mortality Watched; Mc = Control mortality

IV. RESULTS

Determining The Mortality Of Tribolium Castanium Through Silver Nano-Particals Mortality Data After Exposure Of 24 Hrs

To evaluate the mortality by T. castaneum, homogenous adults Was produced in small plastic jars on treated diet. Adults are encouraged to feed on treated diets and data regarding mortality was recorded. Wheat grains were used as diet and three Concentrations were used for each plant extract viz., 5, 10 and 15%. Data on mortality were recorded at 24, 48 and 72 h of exposure period. Insects were kept at 30±2oC and 60±5%RH in incubators for mortality assessment. There were three replicates of each treatment and control. Table 1. reveals the Variance Analysis (ANOVA) of T mean percent mortality data. Castaneum at different Jatropha curcus, Citrus paradise, and R concentrations. Common. Data Showed the key effects, plants (F=4.66; df=1: p<0.05) and concentration (F=11.10 df=2 p<0.05) were significant regarding mortality values of T. castaneum after exposure period of 24 hours.
Table 1. Variance analysis (ANOVA) of the % mortality data for Tribolium castaneum (Herbst) for Silver based nanoparticles

<table>
<thead>
<tr>
<th>S.O.V</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>2</td>
<td>1271.973</td>
<td>635.986</td>
<td>186.330 **</td>
</tr>
<tr>
<td>Concentration (Conc.)</td>
<td>2</td>
<td>926.744</td>
<td>463.372</td>
<td>135.757 **</td>
</tr>
<tr>
<td>Plant*Concentration</td>
<td>4</td>
<td>292.456</td>
<td>73.114</td>
<td>21.421*</td>
</tr>
<tr>
<td>Error</td>
<td>18</td>
<td>61.438</td>
<td>3.413</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>2552.611</td>
<td>635.986</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Comparison of mean percentage morbidity of Tribolium castaneum after exposure to various crop extract concentrations after 24 hours

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>9.15 ± 1.19 c</td>
</tr>
<tr>
<td>10</td>
<td>17.08 ± 2.39 b</td>
</tr>
<tr>
<td>15</td>
<td>23.34 ± 3.62 a</td>
</tr>
</tbody>
</table>

Data in table 2. represents the insecticidal effect of different concentrations of 3 different oils against Tribolium castaneum. The experimental data revealed that maximum mortality was recorded at 15 per cent (23.34 %). The mean mortality was 17.08 % at 10% concentration and 9.15 mortality rate was observed at 5 percent plant extract concentration. From this it is concluded that mortality only increased with increase in 3 different plant concentrations oil and also shows that concentration has major effect on average mortality percentage of T. castaneum.

3. Comparison of mean mortality percentage of Tribolium castaneum after exposure to different plant extracts after 24 hrs

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>8.32 ± 0.82 c</td>
</tr>
<tr>
<td>P2</td>
<td>17.11 ± 1.98 b</td>
</tr>
<tr>
<td>P3</td>
<td>25.76 ± 3.52 a</td>
</tr>
</tbody>
</table>
Table 3. for percent mean mortality values of different plant extracts at different concentration levels showed that extracts of *R. communis* and *Jatropha curcus* gave mortality values 25.76 and 17.11%, correspondingly. While least mortality 8.32% was given by extract of *Citrus paradise*.

4. **Comparative mean percentage mortality of *Tribolium castaneum* after exposure to different plant extract concentrations following 24 hours**

<table>
<thead>
<tr>
<th>Plant extracts x Concentrations (%)</th>
<th>(%) Mean Mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Citrus paradise</em> x 5</td>
<td>5.23±1.83 g</td>
</tr>
<tr>
<td><em>Citrus paradise</em> x 10</td>
<td>10.17±2.56efg</td>
</tr>
<tr>
<td><em>Citrus paradise</em> x 15</td>
<td>12.02±2.89 def</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 5</td>
<td>10.13±1.61 fg</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 10</td>
<td>18.34±1.57 cd</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 15</td>
<td>23.09±2.45 bc</td>
</tr>
<tr>
<td><em>Ricinus communis</em> x 5</td>
<td>13.10±1.68 de</td>
</tr>
</tbody>
</table>

Table 4. showed the interaction between various concentrations (5, 10 and 15 per cent) and different periods of exposure. Mean mortality of *T. castaneum* was given in percentage by the application of extract of *Ricinus communis*, *Jatropha curcus*, *Citrus paradise* oil along with standard error in table 4.

Mean contrast of mortality percentage values for *T. At various concentrations of selected plant extract castaneum was the highest at maximum concentration. Extract of *Ricinus communis* gave the highest mean mortality revealed that maximum mortality (37.07%) at 15% was recorded. The mean mortality was 25.92% at 10% concentration and 13.10% mortality. The concentration of plant extracts was observed at 5 per cent. Extract of *Jatropha curcus* gave the mean mortality revealed that maximum mortality (23.09%) at 15% was recorded. The mean mortality was 18.34% at 10% concentration and 10.13% mortality was observed at 5% concentration of the plant extracts. Extract of *Citrus paradise* gave the mean mortality revealed that maximum mortality (12.02%) at 15% was recorded. The mean mortality was 10.17% at 10% concentration and 5.23% mortality. The concentration of plant extracts was observed at 5%. The result given showed significant association between exposure time and concentration. We concluded from the results, that there was a gradually increase in mortality values with increased plant extract levels.

**Mortality Data After Exposure Of 48 Hrs**

Table 5. Variance analysis (ANOVA) of data on percent mortality of *Tribolium castaneum* (Herbst) for Silver based nanoparticles
Table 6. Contrast of mean percent fertility of Tribolium castaneum after exposure to various plant extract concentrations after 48 hours

<table>
<thead>
<tr>
<th>Plant*Concentration</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>2</td>
<td>1536.53</td>
<td>768.27</td>
<td>189.142**</td>
</tr>
<tr>
<td>Concentration(Conc.)</td>
<td>2</td>
<td>1274.13</td>
<td>637.07</td>
<td>156.841**</td>
</tr>
<tr>
<td>Plant*Concentration</td>
<td>4</td>
<td>145.10</td>
<td>36.28</td>
<td>8.931*</td>
</tr>
<tr>
<td>Error</td>
<td>18</td>
<td>73.11</td>
<td>4.06</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>3028.88</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data in table 6 represents the insecticidal effect of different concentrations of 3 different oil against Tribolium castaneum. The experimental data revealed that maximum mortality (28.13%) at 15% was recorded. The mean mortality was 21.20% at 10% concentration and 11.39% mortality. The concentration of plant extracts was observed at 5%. From this it is concluded that mortality only increased with increasing concentrations of the three different plant oil and also shows that concentration has significant effect on % mean percent mortality of T. castaneum.

7. Comparison of mean percentage mortality of Tribolium castaneum after exposure to different plant extracts after 48 hrs

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>11.39 ± 1.93 c</td>
</tr>
<tr>
<td>10</td>
<td>21.20 ± 2.60 b</td>
</tr>
<tr>
<td>15</td>
<td>28.13 ± 3.72 a</td>
</tr>
</tbody>
</table>

Table 7. for percent mean mortality values of different plant extracts at different concentration levels showed that extracts of R. communis and Jatropha curcus gave mortality values 28.95 and 21.23%, correspondingly. While least mortality 10.56% was given by extract of Citrus paradise.
8. Comparative mean percentage tribolium castaneum mortality following exposure to different plant extract concentrations after 48 hrs

<table>
<thead>
<tr>
<th>Plant extracts x Concentrations (%)</th>
<th>(%) Mean Mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus paradise x 5</td>
<td>5.00±0.00 g</td>
</tr>
<tr>
<td>Citrus paradise x 10</td>
<td>11.67±1.67efg</td>
</tr>
<tr>
<td>Citrus paradise x 15</td>
<td>15.00±0.00 def</td>
</tr>
<tr>
<td>Jatropha curcus x 5</td>
<td>11.67±1.67 fg</td>
</tr>
<tr>
<td>Jatropha curcus x 10</td>
<td>23.34±1.67 cd</td>
</tr>
<tr>
<td>Jatropha curcus x 15</td>
<td>28.67±0.34 bc</td>
</tr>
<tr>
<td>Ricinus communis x 5</td>
<td>17.50±1.68 de</td>
</tr>
<tr>
<td>Ricinus communis x 10</td>
<td>28.61±0.67 b</td>
</tr>
<tr>
<td>Ricinus communis x 15</td>
<td>40.74±0.67a</td>
</tr>
</tbody>
</table>

Table 8. showed the interaction between Various concentrations (5, 10 % and 15 %)and different time period of exposure. Mean mortality of T. castaneum was given in percentage by the application of extract of Ricinus communis, Jatropha curcus, Citrus paradise oil along with standard error in table 8.

Mean comparison of percentage mortality values of T. castaneum at different concentrations of selected plant extract were highest at maximum concentration. Extract of Ricinus communis gave the highest mean mortality revealed that maximum mortality (40.74%) at 15% was recorded. The mean mortality was 28.61% at 10% concentration and 17.50% mortality was observed at 5 per cent plant extract concentration. Extract of Jatropha curcus gave the mean mortality revealed that maximum mortality (28.67%) at 15% was recorded. The mean mortality was 23.34% at 10% concentration and 11.67% mortality was observed at 5% concentration of the plant extracts. Extract of Citrus paradise gave the mean mortality revealed that maximum mortality (15.00%) at 15% was recorded. The mean mortality was 11.67% at 10% concentration and 5.00% Mortality was observed at 5 per cent plant extract concentration. The result given showed significant association between exposure time and concentration. From the results we concluded that mortality values were increasing gradually with an increase in plant extract concentration.

Mortality Data After Exposure Of 72 Hrs

Table 9. Variance analysis (ANOVA) of the percent mortality data for Silver based nano-particle of Tribolium castaneum (Herbst).

<table>
<thead>
<tr>
<th>S.O.V</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>2</td>
<td>1422.21</td>
<td>711.11</td>
<td>92.275**</td>
</tr>
</tbody>
</table>
Concentration(Conc.) | 2 | 1998.33 | 999.16 | 129.655**
---|---|---|---|---
Plant*Concentration | 4 | 399.07 | 99.77 | 12.946*
Error | 18 | 138.71 | 7.71 |
Total | 26 | 3958.33 |

Table 10. Comparison of Tribolium castaneum mean percent mortality after exposure to various plant extract concentrations after 72 hrs.

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>9.70 ± 1.08 c</td>
</tr>
<tr>
<td>10</td>
<td>22.56 ± 2.92 b</td>
</tr>
<tr>
<td>15</td>
<td>30.59 ± 4.18 a</td>
</tr>
</tbody>
</table>

Data in table 10. represents the insecticidal effect of different concentrations of 3 different plant oil against Tribolium castaneum. The experimental data revealed that maximum mortality (30.59 %) at 15% was recorded. The mean mortality was 22.55 % at 10% concentration and 9.70% mortality was observed at 5 per cent plant extract concentration. From this it is concluded that mortality only increased With increased concentrations of the 3 different plant oil and shows also that concentration has a positive effect on the mean percent morbidity of T. Castañea.

11. Comparison of mean percentage mortality of Tribolium castaneum after exposure to different plant extracts after 72 hrs

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>12.78 ± 1.88 c</td>
</tr>
<tr>
<td>P2</td>
<td>19.67± 2.60 b</td>
</tr>
</tbody>
</table>

Table 11. for percent mean mortality values of different plant extracts at different concentration levels showed that extracts of R. communis and Jatropha curcus gave mortality values 30.41 and 19.67%, correspondingly. While least mortality 12.78 % was given by extract of Citrus paradise.

12. Comparative mean percentage mortality of Tribolium castaneum after exposure to different plant extract concentrations following 72 hours
Table 12. showed the interaction between various concentrations (5, 10 and 15 per cent) and different time periods of exposure. Mean mortality of *T. castaneum* was given in percentage by the application of extract of *Ricinus communis*, *Jatropha curcus*, *Citrus paradise* oil along with standard error in table 12.

Mean comparison of percentage mortality values of *T. castaneum* at different concentrations of selected plant extract were highest at maximum concentration. Extract of *Ricinus communis* gave the highest mean mortality revealed that maximum mortality (46.12%) at 15% was recorded. The mean mortality was 32.65% at 10% concentration and 12.45% mortality was observed at 5% concentration of the plant extracts. Extract of *Jatropha curcus* gave the mean mortality revealed that maximum mortality (27.34%) at 15% was recorded. The mean mortality was 21.67% at 10% concentration and 10.00% mortality was observed at 5% concentration of the plant extracts. Extract of *Citrus paradise* gave the mean mortality revealed that maximum mortality (18.34%) at 15% was recorded. The mean mortality was 13.34% at 10% concentration and 6.67% mortality was observed at 5% concentration of the plant extracts. The given outcome showed that interaction of exposure time and concentration was significant. We concluded from the results, that there was a gradually increase in mortality values with increase in concentration of plant extracts.

Determining The Mortality Of *Trogoderma Granarium* Through Silver Nano-Particals

Mortality Data After Exposure Of 24 Hrs

To evaluate the mortality of *T. granarium*, homogenous adults were released on treated diet in small plastic jars. Adults were allowed to feed on treated diet and data regarding mortality was recorded. Wheat grains were used as diet and three Concentrations viz. 5, 10 and 15% of each plant extract were used. Mortality data was recorded for 24, 48 and 72 h of exposure period. For mortality assessment insects incubators were kept at 30±2°C and 60±5% RH. They replicated each treatment and control three times.

Table 13 Reveals the variance analysis (ANOVA) of data on the mean mortality percentage of *T. granarium* at different concentrations of *Jatropha curcus*, *Citrus paradise* and *R. communis*. Data showed that main effects, plants (F=4.66; df=1; p<0.05) and concentration (F=11.10 df=2; p<0.05) were significant regarding mortality values of *T. castaneum* after exposure period of 24 hours.

Table 13. Variance analysis (ANOVA) of data on percent mortality of *T. granarium* (Herbst) for silver based nanoparticles
Table 14. Comparison of mean percent mortality of Trogoderma granarium after exposure to various plant extract concentrations after 24 hours

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4.13±1.19</td>
</tr>
<tr>
<td>10</td>
<td>10.28±2.15</td>
</tr>
<tr>
<td>15</td>
<td>14.40±2.08</td>
</tr>
</tbody>
</table>

Data in table 14. represents the insecticidal effect of different concentrations of 3 different oil against Trogoderma granarium. The experimental data revealed that maximum mortality (14.40%) at 15% was recorded. The mean mortality was 4.13% at 5% concentration and 10.28% mortality was found at a concentration of 10 per cent of plant extracts. From this it is concluded that mortality only increased with increasing concentrations of the three different plant oil and also shows that concentration has significant effect on Mean mortality % of T. granarium.

Table 15. Comparison of mean percentage mortality of Trogoderma granarium after exposure to different plant extracts after 24 hrs

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>4.44±1.30</td>
</tr>
<tr>
<td>P2</td>
<td>8.89±1.61</td>
</tr>
<tr>
<td>P3</td>
<td>15.48±2.25</td>
</tr>
</tbody>
</table>

Table 15. for percent mean mortality values of different plant extracts at different concentration levels showed that extracts of R. communis and Jatropha curcus gave mortality values 15.48 and 8.89%, correspondly. While least mortality 4.45% was given by extract of Citrus paradise.
Table 16. Comparative mean percentage mortality of *Trogoderma granarium* after exposure to different concentrations of plant extracts after 24 hrs

<table>
<thead>
<tr>
<th>Plant extracts x Concentrations (%)</th>
<th>(%) Mean Mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Citrus paradise</em> x 5</td>
<td>1.67±1.67g</td>
</tr>
<tr>
<td><em>Citrus paradise</em> x 10</td>
<td>3.34±1.67efg</td>
</tr>
<tr>
<td><em>Citrus paradise</em> x 15</td>
<td>8.34±1.67def</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 5</td>
<td>3.34±1.67fg</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 10</td>
<td>10.00±0.00cd</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 15</td>
<td>13.34±1.67bc</td>
</tr>
<tr>
<td><em>Ricinus communis</em> x 5</td>
<td>7.40±1.68de</td>
</tr>
<tr>
<td><em>Ricinus communis</em> x 10</td>
<td>17.50±1.68b</td>
</tr>
<tr>
<td><em>Ricinus communis</em> x 15</td>
<td>21.54±1.46a</td>
</tr>
</tbody>
</table>

Table 16. showed the interaction between different concentrations (5, 10 and 15%) and different exposure time period. Mean mortality of *T. granarium* was given in percentage by the application of extract of *Ricinus communis*, *Jatropha curcus*, *Citrus paradise* oil along with standard error in table 16.

Mean comparison of percentage mortality values of *T. granarium* at different concentrations of selected plant extract were highest at maximum concentration. Extract of *Ricinus communis* gave the highest mean mortality revealed that maximum mortality (21.54%) at 15% was recorded. The mean mortality was 17.50% at 10% concentration and 7.40% mortality was observed at 5% concentration of the plant extracts. Extract of *Jatropha curcus* gave the mean mortality revealed that maximum mortality (13.34%) at 15% was recorded. The mean mortality was 10.00% at 10% concentration and 3.34% mortality was observed at 5 per cent plant extract concentration. Extract of *Citrus paradise* gave the mean mortality revealed that maximum mortality (8.34%) at 15% was recorded. The mean mortality was 3.34% at 10% concentration and 1.67% Mortality was observed at 5 per cent plant extract concentration. The result given showed significant association between exposure time and concentration. From the results we concluded that mortality values were increasing gradually with such an increase in plant extract concentration.

**Mortality Data After Exposure Of 48 Hrs**

Table 17. Variance of analysis (ANOVA) of the data concerning % mortality of *T. granarium* (Herbst) for silver based nanoparticles

<table>
<thead>
<tr>
<th>S.O.V</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>2</td>
<td>1608.555</td>
<td>804.278</td>
<td>123.0181**</td>
</tr>
<tr>
<td>Concentration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 18. Comparison of Trogoderma granarium mean percent mortality after 48 hrs of exposure to various plant extract concentrations.

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5.81±1.49</td>
</tr>
<tr>
<td>10</td>
<td>14.18±2.30</td>
</tr>
<tr>
<td>15</td>
<td>22.58±4.77</td>
</tr>
</tbody>
</table>

Data in table 18. represents the insecticidal effect of different concentrations of 3 different oil against Trogoderma granarium. The experimental data revealed that maximum mortality (22.58%) at 15% was recorded. The mean mortality was 5.81% at 5% concentration and 14.18% mortality was observed at 10% concentration of the plant extracts. From this it is concluded that mortality only increased with increase in concentrations of the 3 different plant oil and also shows that concentration has significant effect on percent mean percent mortality of T. granarium.

Table 19. Comparison of the mean percentage mortality of Trogoderma granarium after exposure to different plant extracts after 48 hrs.

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>6.67±1.44</td>
</tr>
<tr>
<td>P2</td>
<td>11.12±1.82</td>
</tr>
<tr>
<td>P3</td>
<td>24.80±4.48</td>
</tr>
</tbody>
</table>

Table 19. for percent mean mortality values of different plant extracts at different concentration levels showed that extracts of R. communis and Jatropha curcus gave mortality values 24.80 and 11.12%, correspondingly. While least mortality 6.67% was given by extract of Citrus paradise.

Table 20. Comparative mean percentage mortality of Trogoderma granarium after exposure to different concentrations of plant extracts after 48 hrs.
<table>
<thead>
<tr>
<th>Plant extracts x Concentrations (%)</th>
<th>( %) Mean Mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Citrus paradise</em> x 5</td>
<td>1.67 ±1.67 g</td>
</tr>
<tr>
<td><em>Citrus paradise</em> x 10</td>
<td>8.34 ±1.67efg</td>
</tr>
<tr>
<td><em>Citrus paradise</em> x 15</td>
<td>10.00 ±0.00def</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 5</td>
<td>5.00 ±0.00fg</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 10</td>
<td>11.67 ±1.67cd</td>
</tr>
<tr>
<td><em>Jatropha curcus</em> x 15</td>
<td>16.67 ±1.67bc</td>
</tr>
<tr>
<td><em>Ricinus communis</em> x 5</td>
<td>10.77 ±1.68de</td>
</tr>
<tr>
<td><em>Ricinus communis</em> x 10</td>
<td>22.56 ±1.68b</td>
</tr>
<tr>
<td><em>Ricinus communis</em> x 15</td>
<td>41.07 ±1.68a</td>
</tr>
</tbody>
</table>

Table 20. showed the interaction between Various concentrations (5, 10 and 15 per cent) and different time periods of exposure. Mean mortality of *T. granarium* was given in percentage by the application of extract of *Ricinus communis*, *Jatropha curcus*, *Citrus paradise* oil along with standard error in table 20.

Mean comparison of percentage mortality values of *T. granarium* at different concentrations of selected plant extract were highest at maximum concentration. Extract of *Ricinus communis* gave the highest mean mortality revealed that maximum mortality (41.07%) at 15% was recorded. The mean mortality was 22.56% at 10% concentration and 10.77% mortality was observed at 5% concentration of the plant extracts. Extract of *Jatropha curcus* gave the mean mortality revealed that maximum mortality (16.67 %) at 15% was recorded. The mean mortality was 11.67% at 10% concentration and 5.00% mortality was observed at 5% concentration of the plant extracts. Extract of *Citrus paradise* gave the mean mortality revealed that maximum mortality (10.00%) at 15% was recorded. The mean mortality was 8.34% at 10% concentration and 1.67 % mortality was observed at 5% concentration of the plant extracts. The result given showed significant association between exposure time and ability to concentrate. From results we concluded that there was a gradually increase in mortality values with increase in concentration of plant extracts.

**Mortality Data After Exposure Of 72 Hrs**

Table 21. Variance of analysis (ANOVA) of the data concerning % mortality of *T. granarium* (Herbst) for Titanium dioxide based nanoparticles

<table>
<thead>
<tr>
<th>S.O.V</th>
<th>DF</th>
<th>SS</th>
<th>MSS</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>2</td>
<td>1141.490</td>
<td>570.745</td>
<td>95.396**</td>
</tr>
<tr>
<td>Concentration</td>
<td>2</td>
<td>1497.094</td>
<td>748.547</td>
<td>125.115**</td>
</tr>
<tr>
<td>Plant*Concentration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>278.498</td>
<td>69.625</td>
<td>11.637*</td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>---------</td>
<td>--------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>18</td>
<td>107.692</td>
<td>5.983</td>
<td></td>
</tr>
<tr>
<td>S.O.V</td>
<td>DF</td>
<td>SS</td>
<td>MSS</td>
<td>F value</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>3024.774</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 22. Comparison of mean percent mortality of *Trogoderma granarium* after visibility to various plant extract concentrations after 72 hours

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>8.59±1.02</td>
</tr>
<tr>
<td>10</td>
<td>18.64±2.63</td>
</tr>
<tr>
<td>15</td>
<td>26.79±3.63</td>
</tr>
</tbody>
</table>

Data in table 22. represents the insecticidal effect of different concentrations of 3 different oil against *Trogoderma granarium*. The experimental data revealed that maximum mortality (26.79%) at 15% was recorded. The mean mortality was 8.59% at 5% concentration and 18.64% Mortality was found at a concentration of 10 per cent of plant extracts. From this it is concluded that mortality only increased with increase in concentrations of the 3 different plant oil and also shows that concentration has significant effect on average mortality by percent of *T. granarium*.

Table 23. Comparison of the mean percentage mortality of *Trogoderma granarium* after exposure to different plant extracts after 72 hrs

<table>
<thead>
<tr>
<th>Concentrations (%)</th>
<th>Mean percentage mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>10.00±1.44</td>
</tr>
<tr>
<td>P2</td>
<td>18.12±2.37</td>
</tr>
<tr>
<td>P3</td>
<td>25.92±4.29</td>
</tr>
</tbody>
</table>

Table 23. for percent mean mortality values of different plant extracts at different concentration levels showed that extracts of *R. communis* and *Jatropha curcus* gave mortality values 25.92 and 18.12%, correspondly. While least mortality 10.00% was given by extract of *Citrus paradise*.

Table 24. Comparative mean percentage mortality of *Trogoderma granarium* after exposure to Variable concentrations of plant extracts after 72 hrs
### Table 24

<table>
<thead>
<tr>
<th>Plant extracts x Concentrations (%)</th>
<th>(%) Mean Mortality ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus paradise x 5</td>
<td>5.00±0.00g</td>
</tr>
<tr>
<td>Citrus paradise x 10</td>
<td>10.00±0.00efg</td>
</tr>
<tr>
<td>Jatropha curcus x 5</td>
<td>10.00±0.00fg</td>
</tr>
<tr>
<td>Jatropha curcus x 10</td>
<td>18.34±1.67 cd</td>
</tr>
<tr>
<td>Jatropha curcus x 15</td>
<td>26.00±1.00bc</td>
</tr>
<tr>
<td>Ricinus communis x 5</td>
<td>10.77±1.68de</td>
</tr>
<tr>
<td>Ricinus communis x 10</td>
<td>27.60±1.68b</td>
</tr>
<tr>
<td>Ricinus communis x 15</td>
<td>39.39±2.91a</td>
</tr>
</tbody>
</table>

Table 24 showed the interaction between various concentrations (5, 10 and 15 per cent) and different time periods of exposure. Mean mortality of *T. granarium* was given in percentage by the application of extract of *Ricinus communis*, *Jatropha curcus*, *Citrus paradise* oil along with standard error in table 24.

Mean comparison of percentage mortality values of *T. granarium* at different concentrations of selected plant extract were highest at maximum concentration. Extract of *Ricinus communis* gave the highest mean mortality revealed that maximum mortality (39.39%) at 15% was recorded. The mean mortality was 27.60% at 10% concentration and 10.77% mortality was observed at 5% plant extract concentration. Extract of *Jatropha curcus* gave the mean mortality revealed that maximum mortality (26.00%) at 15% was recorded. The mean mortality was 18.34% at 10% concentration and 10.00% mortality was observed at 5% concentration of the plant extracts. Extract of *Citrus paradise* gave the mean mortality revealed that maximum mortality (15.00%) at 15% was recorded. The mean mortality was 10.00% at 10% concentration and 5.00% mortality was observed at 5 per cent plant extract concentration. The given outcome showed that the exposure time and concentration interactions were significant. From the results we concluded that mortality values were increasing gradually with an increase in plant extract concentration.

### V. CHARACTERIZATION OF NANOPARTICLES

**Silver Nano-composites**

UV-Visible spectroscopy is one of the techniques most widely used for structural characterisation of silver nanoparticles (green synthesized AgNPs of *Ricinus communis*). Typical for silver nanoparticles, the absorption band is in the region 350 nm to 450 nm. Therefore we can conclude that the nanoparticles recommended for farming level are against pest control because of their cheap quality, supply, eco-friendly nature and good alternative type which is shown in [19].

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.10713

www.ijsrp.org
FTIR observations were conducted to classify the potential biomolecules liable for both the capping and effective stabilization of metal nanoparticles synthesized with leaf broth. The peak IR bands (Fig. 4.2) observed in the dried Ricinus communis leaf at 3409 and 1733 cm\(^{-1}\) are characteristic of the O–H and C=O stretching modes for the OH and C=O groups, possibly of oleuropein, apigenin-7-glucoside and/or luteolin-7-glucoside present in the Ricinus communis leaf\([20]\). The medium band of 1624 cm\(^{-1}\) refers to amide I, the result of carbonyl stretching in proteins\([20]\). The strong peak at 1077 cm\(^{-1}\) is equivalent to the amine stretching vibration of C–N. CH is assigned the peak near 651 cm\(^{-1}\) from plane bending vibrations of the substituted ethylene systems –CH,CH. In the case of nanoparticles, a large shift in the absorbance peak with decreased band intensity from 3436 to 3395 cm\(^{-1}\) and 1420 to 1454 cm\(^{-1}\) was observed, implying binding of the extract's silver ions with hydroxyl and carboxylate groups\([20]\).
VI. CONCLUSION

The current study was directed to investigate the Insecticidal and growth-inhibiting vegetable extracts and new chemistry insecticide formulation of different nano-composites, against Tribolium castaneum. Two bioassays were carried in study including mortality and growth inhibition. The big impact on soil fertility or growth was produced by the tribolium castanum and Trigoderma granarium pests. Different plant extract oil has been used in the past years to control these effects, but it does not work properly. Therefore we can conclude that the nanoparticles recommended for farming level are against pest control because of their cheap quality, supply, eco-friendly nature and good alternative type.

REFERENCES


Figure 5: FTIR Spectra of silver Nano Particles
Changes In Retina, Macula And Optic Nerve With Doxorubicin-Paclitaxel And Cisplastin-Paclitaxel Chemotherapy In Breast Cancer

Cut Apriliza Novita*, Delfi**, Vanda Virgayanti**, Albiner Simarmata***

*Ophthalmology Resident, Departement of Ophthalmology, Sumatera Utara University  
**Ophthalmologist, Departement of Ophthalmology, Sumatera Utara University  
***Oncology Surgeon, Department of Surgeon, Sumatera Utara University

Abstract- Ocular toxicity caused by chemotherapy can be effect into the anatomical, physiological, and biochemical features of the eye. Combination use of Cisplatin, Doxorubicin, and Paclitaxel is often used for breast cancer therapy. This chemotherapy agent has been shown in several studies can cause ocular toxicity.

Method: This is a quasi experimental study. Subjects were patients with breast cancer who underwent Doxorubicin-Paclitaxel or Cisplastin-Paclitaxel chemotherapy. The examination includes visual acuity, intraocular pressure, Amsler grid test, color vision test, changes on retina, macula and optic nerve. Before, after and 3 weeks after chemotherapy.

Results: 120 eyes (60 subjects) grouped into 58 eyes with Cisplastin-Paclitaxel, and 62 eyes with Doxorubicin-Paclitaxel. There was no relationship between visual acuity and intraocular pressure Amsler grid test changes to chemotherapy. There is a significant relationship FM 100 Hue test, retinal, macula and optic nerve changes with chemotherapy.

Conclusion: Doxorubicin-Paclitaxel and Cisplastin-Paclitaxel cause changes in color vision, and also in the retina, macula, and optic nerve.

Index Terms- Chemotherapy, Cisplatin, Doxorubicin, Ocular Toxicity, Paclitaxel

I. INTRODUCTION

Chemotherapy is a treatment using drugs that aim to destroy or slow the growth of cancer cells. Chemotherapy side effects arise because the chemotherapy drugs not only destroy cancer cells but also attack healthy cells, especially cells that divide rapidly.1

Patients with cancer or malignancy in addition to can experience the benefits of chemotherapy, will also feel the side effects or effects toksikn that ditimbukan by the administration of chemotherapeutic agents. chemotherapy can cause disturbances in vision function due to the presence of toxicity effects.2 The Eye and adnexa can be susceptible to anticancer therapy targeted because many of the molecules is disturbed. Lesions of the posterior segment is one of the important parts because the loss of vision can occur.2,3 Retina is part of the ocular which is active in metabolic in the body, making it a prime target for unwanted side effects from chemotherapy agents.4

Side effects that occur due to the administration of chemotherapy agents due to the occurrence of the mechanism of neurotoxicity in ocular still need to be further studied, such a hypothesis due to ischemic or electrophysiological can not fully explain the pathogenesis of neurotoxicity ocular. Neurotoxicity ocular associated with the administration of chemotherapeutic agents such as Cisplatin, Doxorubicin and Paclitaxel, Although rare, several case reports previously showed that the presence of visual impairment due to the neurotoxicity that occurs due to administration of chemotherapy should be considered in treating the neoplastic disease patient, the administration of chemotherapeutic agents such want to proceed.5,6

II. METHOD

This is a quasi experimental design study with control was approved by the ethics committee of Medical Faculty of Sumatera Utara University. The subjects were all patients who admitted to the Murni Teguh Hospital Medan. The subjects were all patients who was diagnosed with breast cancer from January to July 2020. Total sample was 60 people with age over 18 years. From 126 eyes, there were 6 eyes drop out from study because the patient didn’t come for the second and third examinations.

This study discusses several assessments of the vision system relating to the effects that may occur in patients undergoing chemotherapy. The chemotherapy agents given are Doxorubicin-Paclitaxel and Cisplastin-Paclitaxel. The study was conducted with a assessment of visual acuity, intraocular pressure, central vision, color vision, retinal, macula and optic nerve. The assessment are before, after and 3 weeks after first chemotherapy. Visual acuity test using Snellen Chart examination, intraocular pressure using Topcon Non contact Tonometer, color vision with Farnworth Munsell 100 Hue test, central vision function with Amsler Grid Test, Posterior Segment (retina, macula, and optic nerve) with Ullman Indirect and 20 D lens. All data is analyzed using IBM SPSS Statistic 26 for Windows.

III. RESULT

In this study there were 120 eyes examined. Previously there were 3 people (6 eyes) with drop out cases because they were not present during the second or third examination during the study. The chemotherapy agents given are Doxorubicin-Paclitaxel...
and Cisplatin-Paclitaxel. The average age is 49. The youngest is 39 years old and the oldest is 69 years old. Time of diagnosis breast cancer is categorized into 3 i.e. 0 – 12, 13 – 24 and 25 – 36 months.

Statistically, with a Chi square test found that there is no relationship between visual acuity before, after chemotherapy. The results of the amsler grid test obtained in the study subject as a whole the subject's eyes have a normal value on the Amsler grid test results. By using chi square test , there was no significant relationship between Amsler grid test to the two chemotherapy agents.

The results of the FM 100 Hue test after first chemotherapy (FM 100 H1) on the two chemotherapy agents (p. 0.001). Retinal examination results found that the number of normal retina is decreasing from before, after and 3 weeks after first chemotherapy. Statistically, it was found with chi square test, there was a significant relationship between retinal characteristics after first chemotherapy (Retina H1) to the two chemotherapy agents (p. 0.029). The results of the examination on macula, in the normal category have a larger number than edema. The table also shows that macular edema in Cisplatin-Paclitaxel has a number of more than the Doxorubicin-Paclitaxel. However statistically, using the Chi square test showed that there is no relationship between macular before, after and 3 weeks after first chemotherapy to the two chemotherapy agents.

This study with the assessment of the function of visual acuity, intraocular pressure, central vision, color vision, retina, macula and optic nerve. Before, after 1st chemotherapy and 3 weeks after chemotherapy. In table 2. Show data about the distribution of characteristics and the relationship of the characteristics to chemotherapy, before (H0), after 1st chemotherapy (H1) and 3 weeks after chemotherapy (H2).

The results of the visual acuity examination varied from normal 6/6 to < 3/60. There appeared to be an increase in the number of eyes with visual acuity category both from the time before and after chemotherapy. Statistically, with a Chi square test found that there is no relationship between visual acuity before, after first chemotherapy and 3 weeks after first chemotherapy.

The results of intraocular pressure examination obtained the value of the intraocular pressure that low of 8 mmHg and the highest was 21 mmHg. However with fisher exact test there was no significant relationship between intraocular pressure before, after first chemotherapy and 3 weeks after first chemotherapy to the both of agent chemotherapy.

Table 1. Distribution Characteristics of Subjects

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemotherapy agent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doxorubicin-Paclitaxel</td>
<td>31</td>
<td>51.7</td>
</tr>
<tr>
<td>Cisplatin-Paclitaxel</td>
<td>29</td>
<td>48.3</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35 – 49 years</td>
<td>36</td>
<td>60.0</td>
</tr>
<tr>
<td>50 – 69 years</td>
<td>24</td>
<td>40.0</td>
</tr>
<tr>
<td>Time of Cancer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 12 month</td>
<td>46</td>
<td>76.7</td>
</tr>
<tr>
<td>13 – 24 month</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td>25 – 36 month</td>
<td>8</td>
<td>13.3</td>
</tr>
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</table>

Table 2. Distribution Character of Subject and Association between Characteristic to chemotherapy agent

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>H0</th>
<th>H1</th>
<th>H2</th>
<th>p.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Acuity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6/6 – 6/12</td>
<td>35 (46.7%)</td>
<td>40 (53.3%)</td>
<td>40 (48.2%)</td>
<td>43 (51.8%)</td>
</tr>
<tr>
<td>&lt; 6/12 – 6/18</td>
<td>4 (50.0%)</td>
<td>4 (50.0%)</td>
<td>5 (50.0%)</td>
<td>5 (50.0%)</td>
</tr>
<tr>
<td>&lt; 6/18 – 6/60</td>
<td>14 (63.6%)</td>
<td>8 (36.4%)</td>
<td>10 (83.3%)</td>
<td>2 (16.7%)</td>
</tr>
<tr>
<td>&lt; 6/60 – 3/60</td>
<td>9 (64.3%)</td>
<td>5 (35.7%)</td>
<td>7 (58.3%)</td>
<td>5 (41.7%)</td>
</tr>
<tr>
<td>&lt; 3/60</td>
<td>0 (0%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
<td>3 (100%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intraocular Pressure</th>
<th>H0</th>
<th>H1</th>
<th>H2</th>
<th>p.</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10 mmHg</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td>10 – 21 mmHg</td>
<td>61 (51.3%)</td>
<td>58 (48.7%)</td>
<td>62 (52.1%)</td>
<td>57 (47.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amsler Grid Test</th>
<th>H0</th>
<th>H1</th>
<th>H2</th>
<th>p.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>55 (51.4%)</td>
<td>52 (48.6%)</td>
<td>60 (52.2%)</td>
<td>55 (47.8%)</td>
</tr>
<tr>
<td>Metamorphopsia</td>
<td>7 (70.0%)</td>
<td>3 (30.0%)</td>
<td>1 (33.3%)</td>
<td>2 (66.7%)</td>
</tr>
<tr>
<td>Scotoma</td>
<td>0 (0%)</td>
<td>2 (100%)</td>
<td>0 (0%)</td>
<td>1 (100%)</td>
</tr>
<tr>
<td>Metamorphopsia,Scotoma</td>
<td>0 (0%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Metamorphopsia,Macropsia</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
Table 3 show data about the relationship of changes in each characteristic. In this case it is assessed on the changes in the $H_0H_1$ and $H_1H_2$ on each chemotherapy agent (Doxorubicin-Paclitaxel and Cisplatin-Paclitaxel). The changes here include decreased, constant and increased categories compared when $H_0$ to $H_1$ and $H_1$ to $H_2$ for each chemotherapy agent on each characteristic.

In the changes in visual acuity, there are several changes in visual acuity. The changes here include decreased, constant and increased categories. However, statistical analysis using the Chi square test, there was no relationship between changes in $H_0H_1$ and $H_1H_2$ in the eye with the Doxorubicin-Paclitaxel or Cisplatin-Paclitaxel. At changes in intraocular pressure $H_0H_1$ and intraocular pressure $H_1H_2$ in each chemotherapy agent. However, with the Chi Square test there was no relationship between changes in intraocular pressure in $H_0H_1$ and $H_1H_2$ in the eye with Doxorubicin-Paclitaxel or Cisplatin-Paclitaxel. Amsler grid test of $H_0H_1$ and $H_1H_2$ in each chemotherapy agent. However, with the Mean Whitney test and fischer exact test there was no relationship between changes in Amsler grid test in $H_0H_1$ and $H_1H_2$ in the eye with Doxorubicin-Paclitaxel or Cisplatin-Paclitaxel. The changes in the FM 100 Hue test results $H_0H_1$ and $H_1H_2$ on each chemotherapy agent. However, with the Chi Square test, there was no relationship between changes in FM 100 test results on $H_0H_1$ and $H_1H_2$ in the eyes with Doxorubicin-Paclitaxel or Cisplatin-Paclitaxel.

In retinal changes to chemotherapy agents, there was a change in the retina of $H_0H_1$ in the subject's eye to the chemotherapy agent. From the chi square test results can be seen that there is a significant relationship between changes in the retina $H_0H_1$ to chemotherapy agents.

Changes in macular $H_0H_1$ and $H_1H_2$ in subjects to chemotherapy agents. Mann-Whitney tests found statistically that there was a significant relationship between changes in the $H_0H_1$ macula to chemotherapy agents. But in $H_1H_2$ there was no significant macular change to the chemotherapy agent.

Changes in the optic nerves $H_0H_1$ and $H_1H_2$ in subjects against chemotherapy agents. Using the Chi Square test it can be concluded that there is no relationship between changes in the optic nerve $H_0H_1$ and $H_1H_2$ to the two chemotherapy agents.

Table 3. Distribution Characteristic Changes $H_0H_1$ and $H_1H_2$ to Chemotherapy Agent

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Time</th>
<th>Alteration</th>
<th>Doxorubicin-Paclitaxel n (%)</th>
<th>Cisplatin-Paclitaxel n (%)</th>
<th>p.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Acuity</td>
<td>$H_0H_1$</td>
<td>Decreased</td>
<td>5 (45.5%)</td>
<td>6 (54.5%)</td>
<td>0.911</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Constant</td>
<td>35 (52.5%)</td>
<td>32 (47.8%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased</td>
<td>22 (52.4%)</td>
<td>20 (47.6%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$H_1H_2$</td>
<td>Decreased</td>
<td>3 (75.0%)</td>
<td>1 (25.0%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Constant</td>
<td>49 (52.7%)</td>
<td>44 (47.3%)</td>
<td>0.466</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased</td>
<td>10 (43.5%)</td>
<td>13 (56.5%)</td>
<td></td>
</tr>
<tr>
<td>Intraocular Pressure</td>
<td>$H_0H_1$</td>
<td>Decreased</td>
<td>28 (57.1%)</td>
<td>21 (42.9%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Constant</td>
<td>7 (38.9%)</td>
<td>11 (61.1%)</td>
<td>0.411</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased</td>
<td>27 (50.9%)</td>
<td>26 (49.1%)</td>
<td></td>
</tr>
</tbody>
</table>
Table 4 show data on changes in $H_0H_1$ to $H_1H_2$ for each of the chemotherapy agents (Doxorubicin-Paclitaxel and Cisplatin-Paclitaxel). Each characteristic was tested by Wilcoxon test and several changes occurred.

Changes in visual acuity show that there are negative changes that occur more in Doxorubicin-Paclitaxel than Cisplatin-Paclitaxel, but in ties (same condition) and positive changes have the same amount on both chemotherapy agents. However, statistically using the Wilcoxon test, it was found that there was no significant change between visual acuity $H_0H_1$ to $H_1H_2$ for each chemotherapy agent.

Changes in intraocular pressure for each chemotherapy agent. there are more positive changes in Doxorubicin-Paclitaxel than Cisplatin-Paclitaxel. Statistically, using the Wilcoxon test, there was no significant change between intraocular pressure $H_0H_1$ to $H_1H_2$ for each chemotherapy agent.

Changes in the Amsler grid test for each chemotherapy agent. There were more ties than negative or positive changes in both agents and statistically using the Wilcoxon test there was also no significant change between the Amsler grid test $H_0H_1$ to $H_1H_2$ for each chemotherapy agent.

Changes in FM 100 test for each chemotherapy agent, there were negative and positive changes in both agents but statistically using the Wilcoxon test there was no significant change between FM 100 test $H_0H_1$ to $H_1H_2$ for each chemotherapy agent.

However, on the retina, macula and optic nerve using the Wilcoxon test, it was found that there was a significant change in $H_0H_1$ to $H_1H_2$ with Doxorubicin-Paclitaxel.
Table 4. Distribution Characteristic Changes H₀-H₁ to H₁-H₂ Chemotherapy Agent

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Chemotherapy</th>
<th>Alteration</th>
<th>Rank</th>
<th>n</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Acuity</td>
<td>Doxorubicin-Paclitaxel</td>
<td>Negatif rank</td>
<td>20</td>
<td>9</td>
<td>0.077</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positif rank</td>
<td>9</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Ties</td>
<td>33</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Cisplastin-Paclitaxel</td>
<td>Negatif rank</td>
<td>16</td>
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<tr>
<td></td>
<td></td>
<td>Positif rank</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ties</td>
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<td></td>
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</tr>
<tr>
<td>Intraocular Pressure</td>
<td>Doxorubicin-Paclitaxel</td>
<td>Negatif rank</td>
<td>26</td>
<td></td>
<td>0.613</td>
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<tr>
<td></td>
<td></td>
<td>Ties</td>
<td>15</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Cisplastin-Paclitaxel</td>
<td>Negatif rank</td>
<td>25</td>
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<td>0.349</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Positif rank</td>
<td>16</td>
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<tr>
<td></td>
<td></td>
<td>Ties</td>
<td>17</td>
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</tr>
<tr>
<td>Amsler Grid Test</td>
<td>Doxorubicin-Paclitaxel</td>
<td>Negatif rank</td>
<td>6</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Ties</td>
<td>54</td>
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<td></td>
</tr>
<tr>
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<tr>
<td></td>
<td></td>
<td>Ties</td>
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<tr>
<td>FM 100 Hue Test</td>
<td>Doxorubicin-Paclitaxel</td>
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</tr>
<tr>
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<td>Positif rank</td>
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<tr>
<td></td>
<td></td>
<td>Ties</td>
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<tr>
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<td>Ties</td>
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<td>Retina</td>
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<td>Positif rank</td>
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<td>Ties</td>
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</tr>
<tr>
<td></td>
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<td>10</td>
<td></td>
<td>1.000</td>
</tr>
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<td></td>
<td>Positif rank</td>
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<td></td>
<td></td>
<td>Ties</td>
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<tr>
<td>Macula</td>
<td>Doxorubicin-Paclitaxel</td>
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</tr>
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<td></td>
<td></td>
<td>Ties</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cisplastin-Paclitaxel</td>
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<td>0.234</td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ties</td>
<td>52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optic Nerve Head</td>
<td>Doxorubicin-Paclitaxel</td>
<td>Negatif rank</td>
<td>0</td>
<td></td>
<td>0.038</td>
</tr>
<tr>
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<td>Positif rank</td>
<td>5</td>
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<tr>
<td></td>
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<td>Ties</td>
<td>57</td>
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<td></td>
</tr>
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<td></td>
<td>Cisplastin-Paclitaxel</td>
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</tr>
<tr>
<td></td>
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<td>Positif rank</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Ties</td>
<td>51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV. DISCUSSION

Patients with cancer or malignancy may benefit from advances in chemotherapy, but chemotherapy agents also cause toxic effects. In recent years, it has been reported that chemotherapy can cause impaired vision function due to toxicity in chemotherapy.

The subjects of the study were women with an average age of 49 years with the youngest being 39 years old and the oldest being 69 years old. In line with data from the Indonesian Ministry of Health, it is high increase in the prevalence of cancer in the age group 25-34 years, 35-44 years, and 45-54 years. The chemotherapy agents given are Doxorubicin-Paclitaxel and Cisplastin-Paclitaxel chemotherapy agents. Both of these agents are combination chemotherapy agents used in patients with breast cancer. This study was conducted by assessing visual acuity function, intraocular pressure, central vision function, color vision function, retinal condition, macula and optic nerve before, after chemotherapy and 3 weeks after chemotherapy agents. The number of eyes examined in this study amounted to 120 eyes from 60 patients. Where previously there were 3 people (6 eyes) with cases of drop out because they did not come during the second or third examination during the study. The length of time a patient suffered from breast cancer was calculated from the time of diagnosed, and in this study 46 people were categorized into 3 - 12 months, 6 people 13-24 months and 8 25 - 36 months.

In this study it was found that there was no relationship and changes between visual acuity before, after chemotherapy and 3...
weeks after chemotherapy. This is in line with research by Scaioli, visual acuity with Paclitaxel chemotherapy is reported to cause blurred vision, scotoma and photopsia. In some patients, it was found when chemotherapy was started, but it can also be during and after chemotherapy, but there was no relationship between the chemotherapy protocol and the appearance of these symptoms. In his study also found no significant association with decreased visual acuity during chemotherapy.8

The results showed that the lowest intraocular pressure was 8 mmHg and the highest was 21 mmHg. On examination of intraocular pressure, it was found that there was no relationship and changes between intraocular pressure before, after chemotherapy and 3 weeks after chemotherapy. In line with research conducted by Berker Bakbak et al. there was no significant difference in intraocular pressure before and after chemotherapy.9

The results of the study to see the central vision function using the Amsler grid test, which shows that the results obtained from the amsler grid test in the study subjects were normal, Metamorphopsia, Scotoma, Metamorphopsia with Scotoma, Metamorphopsia and Macropsia. In the Amsler grid examination, it was found that there was no relationship and change between the results of the Amsler grid test before, after chemotherapy and 3 weeks after chemotherapy. This may occur because the use of Paclitaxel, as reported by Scaioli, stated in his research related to Positive Spontaneous Visual Symptoms (PSVS) on the administration of the chemotherapy agent Paclitaxel which manifests as photopsia, scotoma and impaired visual acuity, these symptoms if found, usually transient.5

The color vision function test using the Farnsworth Munsell 100 Hue Test, it was found that there was a significant relationship between the results of the FM 100 Hue test after chemotherapy (FM 100 H∞) on the two chemotherapy agents. This is as has been reported by Simon Dulz et al and Wilding et al researching the toxicity of the retina after giving the chemotherapy agent Cisplastin in cancer that in their study it was found that 9 eyes out of 6 patients observed during the study had color vision disorders. And in approximately 38% of patients who received Cisplastin chemotherapy, Cone and Rod had dysfunction.10,11

On examination of the retina using indirect funduscopy, it was found that the retinal characteristics were Normal, hemorrhage, pigmented changes, Cotton Wool Spot (CWS), retinal hemorrhage with pigment changes, retinal hemorrhage with Cotton Wool Spot and retinal hemorrhage, CWS with retinal pigment changes. And in this study it was found that there was a significant relationship between retinal characteristics after chemotherapy (Retina H∞), and there was a significant change in the retina H∞ for both chemotherapy agents and there was a significant change in the retina H∞ to H2 for Doxorubicin-Paclitaxel. Reported some research state that cancer patients undergoing chemotherapy with Cisplastin and Paclitaxel and Doxorubicin will have a toxic effect on the retinal structure. Cisplatin is an effective chemotherapy for cases with various solid tumors. Which has side effects / toxicity on the ocular system. Among them are maculopathies with a form of pigment changes caused by retinal pigment disorders, changes in color perception caused by photoreceptor dysfunction and mild retinal ischemia such as cotton wool spots and retinal hemorrhage.5,6,10–15

Macular examination results obtained in this study were normal and macular edema. There is a significant relationship between H∞H∞ macular changes to chemotherapy agents and there is a significant change in H∞H∞ to H2H2 macular with Doxorubicin-Paclitaxel. This is in line with some research, It was found that a significant increase in macular thickness with the use of Paclitaxel was associated with an increase in macular thickness for the incidence of Cystoid macular edema due to impaired retinal blood barrier.16,17,18

In this study, the results of examination on the optic nerve were found to be Normal, Grade 1. Very early papilledema, Grade 2. Early papilledema and Grade 3. Moderate papilledema which was applied through the Frisen Grading System. There was a significant change in the optic nerves head (ONH) H∞ to H2 with Doxorubicin-Paclitaxel. In line with studies by Scaioli et al. Capri et al., and Caraceni et al. The occurrence of reduced amplitude of the P100 component with a slight delay in elongation, measured by VEPs in patients using Doxorubicin and paclitaxel, showed an occurrence / disturbance in the optic nerve. Reported 3 cases with visual impairment and optic nerve disorders on Paclitaxel use.15,19,20

However, in our study there are still limitations such as classifying chemotherapy doses, short administration times (chemotherapy cycles) and searching for causes of abnormalities that occur before chemotherapy that may be related to the incidence of Cancer Associated Retinopathy.

V. CONCLUSION

Patient with breast cancer undergoing chemotherapy should be ocular examination before, during and after chemotherapy. From our study that grouped into 58 eyes with Cisplastin-Paclitaxel, and 62 eyes with Doxorubicin-Paclitaxel. We found there was no relationship between visual acuity, intraocular pressure and, Amsler grid test changes to chemotherapy. There is a significant relationship FM 100 Hue test, retinal, macula and optic nerve changes with chemotherapy. Doxorubicin-Paclitaxel and Cisplastin-Paclitaxel chemotherapy cause changes in color vision, and also in the retina, macula, and optic nerve.

REFERENCES


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The Causes Violence against Afghan Women and Recommended Solutions

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Abstract- This paper tends to be about violence against women in Afghan society and offers some solutions for making a safe society for women. This paper also analyzes the UNAMA Report on the causes of violence against Afghan women in 2018. It also describes the experiences of an Afghan woman whose nose has been cut off by her husband and is published on The New York Times, and lastly the paper offers solutions that could help make a safer society for women.

Index Terms- Afghanistan, violence, solutions, women

I. INTRODUCTION

Afghanistan, a country which has experienced more than 30 years of war, is not safe for women. Every individual suffers from the outcomes of war, specifically economic problems, poverty, unemployment, mental health problems, violence, loss, literacy and education related problems. However, women face peculiar challenges within the violent context of Afghanistan.

In Afghan Society, women lived completely in prohibition. They have kept silence against injustice while this silence explained some painful facts that could not be hidden. Although, in Article 22 Afghan Constitution it was approved that: “Any kinds of discrimination and privilege among the Afghan citizens is prohibited.” “Afghan citizens both men and women have equal rights and duties in front of law.”

A 2018 report from the United Nations Human Rights office in Afghanistan says that armed conflict has killed and wounded women and girls (350 deaths and 802 injured), and it represents a six percent decrease from 2017 (The United Nations Assistance Mission in Afghanistan, 2019).

Domestic violence is another core problem within this country. WHO, World Health Organization, claims that approximately 90% of Afghan women have experience of at least one kind of domestic violence. Another form of violence is sexual harassment. Sexual harassment and especially in workplace is getting common her. Even the women police force is not safe from this phenomenon. To address sexual harassment against women in the police force and the workplace, the Ministry of the Interior worked on finalizing its internal complaints procedure, thereby implementing the decision made in July 2016 to establish such a mechanism, which, pursuant to the presidential order issued in 21 November 2016 instructing all security sector agencies to improve workplace safety for women. According to the report of the Afghanistan Independent Human Rights Commission released on 25 November 2017, entitled “Situation of Women Employed in Defense and Security Sectors”, of 579 female respondents in the police force, 20 per cent claimed that they had experienced sexual harassment in the workplace.

II. SCOPE OF THE RESEARCH STUDY

The 2018 report from the United Nations Human Rights office in Afghanistan that I mentioned in the former part details as follow:

Leading Causes of Women Casualties:
- Ground Engagements (50 per cent): 576 women casualties (132 deaths and 444 injured)
- Suicide and Complex Attacks (16 per cent): 185 women casualties (52 deaths and 133 injured)
- Aerial Operations (13 per cent): 156 women casualties (84 deaths and 72 injured)
- IEDs (non-suicide) (12 per cent): 137 women casualties (43 deaths and 94 injured)

The aims of the larger research study were as follows:

1. To identify the traumatic and violent life events in the personal life of the women in Afghanistan
2. To identify the stressful and harmful events in the workplace of Afghan women.
3. To recommend some solutions for the mentioned problems

Based on above data, I can classify, cases of violence against women into five categories:
1. Physical violence
2. Sexual violence
3. Verbal and psychological violence
4. Economic violence
5. Other forms of violence

To give this research a very clear image, I have an example of severe cruel action applied on an Afghan woman, Reza Gul.

III. REZA GUL’S STORY

In a news published by New York Times on Jan. 19, 2016, introduces Reza Gul whose nose is cut off by his husband in Faryab Province of Afghanistan. Reza Gul, 20 as of 2016, was attacked by her husband with a knife on in Shar-Shar, a village in an underdeveloped and Taliban-controlled part of Faryab
Province. During the six years Reza Gul and her husband, Muhammad Khan, 25 as of 2016, have been married, he and members of Muhammad Khan’s family have regularly abused her, beating her and tying her in chains, explained Reza Gul’s mother, Zarghona.

Mr. Khan regularly went to Iran for work, returned for a few months during which he abused his wife; then left Reza Gul with his family, Zarghona said. Zarghona said, “This infidel cut off my daughter’s nose,” “If I catch him, I’ll tear him to pieces.” The attack happened on Sunday afternoon, Zarghona claimed. The husband and wife got into a rage quarrel over Muhammad Khan having engaged with his uncle’s 6- or 7-year-old daughter, with the intention of making her his second wife this year. In process of heat argument, Mr. Khan uncontrollably got angry, took a knife and cut off his wife’s nose, explained Zarghona.

Post attack, the husband and one of his brothers placed Reza Gul on the motorcycle to take her away and finish her life, Zarghona said. Luckily, the event got attention of the village, led to a protest, and Mr. Khan fled for his life. Her mother went to the Taliban and asked them for assistance on the issue. ‘Is this the protest, and Mr. Khan fled for his life. Her mother went to the Taliban and asked them for assistance on the issue. ‘Is this the Islam we are following? My daughter’s nose chopped off! But you are doing nothing about it. I want justice.’ Said Zarghona to Taliban. Reza Gul is currently hospitalized in northern Afghanistan and chances are there that she will be sent to Turkey for treatment.

IV. RECOMMENDED SOLUTIONS

- Increasing public awareness of the rights and social privileges of citizens. In particular, the legal status of women in the family and society by developing and implementing programs and extensive continuous education by the Ministry of Education, Higher Education, Hajj and Religious Affairs, Justice, Women’s Affairs and other ministries.
- Creating job opportunities and income generation works for women to ensure financial independence and eliminate severe financial dependency of women to men.
- Creating administrative opportunities for women in the high levels of public and private agencies and institutions and involving them in decision making, macroeconomic national policy in order to ensure the permanent guarantees for the protection of women's role in public life.
- Creating effective strategies to combat superstitious traditions harming women’s human rights, contributing continuation of patriarchal culture.
- Assuring appropriate, committed and expert capacities in the judicial system to eliminate the culture of impunity, and serious fight against those who continue to support impunity.
- Increasing of special attorney offices to fight violence against women, and increasing of the staff of these offices in all provinces, and making registration of marriage and the use of marriage contracts compulsory in the country.
- Ratification of the Law on Elimination of Violence Against Women and the practical implementation of this Law.
- Modifying and revising of some of the provisions of the laws that are in conflict with the values of human rights especially women's rights.
- Criminalization of some examples of violence such as rape and honor killings in the laws specifically in the Law on Elimination of Violence against Women and criminal law.
- Increasing Police’s and security forces’ awareness and knowledge of human rights standards to promote a spirit of responsibility and respect for human rights.
- Creating facilities for women's access to justice and judicial authorities at central and provincial levels to enhance the enjoyment of legal protection of women victims of violence.

V. CONCLUSION

Reza Gul’s case is just an example of violence that is experienced by women in this country and around the world. It is painful that Reza Gul and many other women experience violence from their own family members, whether that be their fathers, brothers, husbands, brother-in-law’s or any other men in their family and from their society and colleagues. However, Reza Gul’s story also highlights that during the decades of war and insecurity, women tolerated these challenges for the good name of the family, for the future of their children and for their hope and strong religious beliefs.

It is obligation of every citizen to raise his/her voice against this evil phenomenon. Ban Ki-moon, former Secretary-General of the United Nations, said “We must unite. Violence against women cannot be tolerated, in any form, in any context, in any circumstance, by any political leader or by any government.”.

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Impact of Covid-19 on Garment Sector in Bangladesh

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Abstract- Bangladesh is a developing country with remarkable economic growth (growing around 7% average growth rate last 10 years). The recent COVID-19 pandemic has caused colossal damage in this emerging South Asian nation most notably in public health, social well-being, and Education in Bangladesh. This paper aims to study the Coronavirus (Covid-19) consequences to the garment sector of Bangladesh and the garment workers. This virus has had a detrimental impact on the Garment’s owner and the workers, as a result, find themselves unemployed, with many exhausting their savings they stare at possible starvation and return to perpetual poverty. Experts have opined that the current scenario will continue to exist for now and is likely to cause more deaths, taking a toll on the already miserable condition of the economy, public health and employment; causing much distress among the people mentally and physically. Adding to woes the export of Ready-made Garment (RMG) is also less than the expected which is a serious cause of concern. Owing to this, foreign direct investment (FDI) and Foreign Institutional Investment (FII) has taken a hit with the outcome being a trade deficit. The domestic currency has weakened as a consequence of foreign currency. The various financial stimulus or relief should be taken to tackle the problem like subsidies, certain tax relief in the response to the COVID-19 pandemic and import duty exemption on medical and protective equipment.


I. INTRODUCTION

COVID-19 today has gripped the attention all around the world due to its deadly impact rendering the World to a standstill. It is subsequently named after SARS-Cov-2. Some experts believe that its origin is from the wholesale food market at Hubei province in China. Most of the infected persons in its incipient stage were related to this market such as stall owners, retailers, employees, and consumers. Later this province was declared as the source of the Covid-19 outbreak, and as a result in January 2020 market had been closed. After a month, the virus started spreading to other countries notably in the USA, INDIA, BRAZIL, ARGENTINA, RUSSIA, and SPAIN. This virus is contagious and spreads typically from person to person by sneezing, coughing (droplet transmission) and touching a contaminated surface. Many times, the infected person can be asymptomatic i.e. they could already be infected with the virus but symptoms may not be visible. Symptoms generally show up in about 14 days and transmission is hence possible before having any symptoms. Recommended precautionary measures such as washing hands with hand wash, using musk, avoid handshake, maintaining one-meter distance, self-isolation of 14 days for those who travelled to infected areas or if someone is suspected as a possible victim are prescribed. The origins can be traced back to China but the virus has suffused to almost every country today. According to research, published in the Lancet, the research predicted that 6.4% of Covid-19 infected people older than 60 could die, but this could rise to 13.4% for those who are above 80 years of age. As of 20 October 2020, the USA is having the highest number of cases followed by India, Brazil, Russia, Spain, Colombia, and Bangladesh enlisted as 16 positions out of 216 countries.
TABLE-1: Number of COVID cases and Death due to Covid-19

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Cases</th>
<th>Total REVOVERTED</th>
<th>Total Deaths</th>
<th>Total tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>8,468,223</td>
<td>5,513,584</td>
<td>2,25,451</td>
<td>127138924</td>
</tr>
<tr>
<td>India</td>
<td>7,644,979</td>
<td>6,784,742</td>
<td>1,15,879</td>
<td>96116771</td>
</tr>
<tr>
<td>Brazil</td>
<td>5,255,277</td>
<td>4,681,659</td>
<td>15,4327</td>
<td>17,900,000</td>
</tr>
<tr>
<td>Russia</td>
<td>1,431,635</td>
<td>1,085,608</td>
<td>24,635</td>
<td>54,675,096</td>
</tr>
<tr>
<td>Spain</td>
<td>1,015,795</td>
<td>N/A</td>
<td>33,992</td>
<td>15,503,165</td>
</tr>
<tr>
<td>Argentina</td>
<td>1,002,662</td>
<td>803,965</td>
<td>26,716</td>
<td>2,626,406</td>
</tr>
<tr>
<td>Colombia</td>
<td>965,883</td>
<td>867,961</td>
<td>29,102</td>
<td>4,467,051</td>
</tr>
</tbody>
</table>

Source: WorldoMeter

To deal with this pressing scenario, Vaccines must be developed. Many countries are working on it with an enormous amount of budget but there is uncertainty about whether the cure would be developed in time. Now every country is well acquainted with the challenges this pandemic brings specifically on the economic front. Major Economies of the world have revised their growth estimates which are set to fall drastically. For instance, the Japanese economy has entered into a recession due to dampening consumer spending and exports. The ill-effects are more appalling in developing economies like that of Bangladesh. GDP of Bangladesh depends on Agriculture, industry, financial institution. In October 2019, the International Monetary Fund (IMF) predicted a 7.4% growth rate for the Financial year of 2020-2021. Due to Covid-19, in mid of April 2020, (IMF) has revised the growth estimates and now says Bangladesh will be having only 2% GDP growth in this Financial year (2020-2021). Because most of the people of Bangladesh depend on agriculture which is having 3rd largest contributor to GDP after Service and industry. Moreover, the financial market is being threatened by a massive financial crisis. Dhaka Stock Exchange (DSE) and Chattogram Stock Exchange (CSE) is the country’s major bourse being collapsed in this situation and financial institutions got liquidity crises because of financial instrument monetization. On the other hand, employees are losing their job and others are not getting a proper salary. One-third of Garments workers have lost their job because of declining foreign order amid this Pandemic situation. Bangladesh has emerged the opportunity to lead the garments manufacturing (RMG) sector. Bangladesh is the second-best readymade garment exporter after China, accounting for 81% of the total export rate and contributes nearly 20% to Gross Domestic Products (GDP) from textile and apparel. This sector employs approximately 20 million workers in the country. Bangladesh had the plan to get into a middle-income country by the forthcoming financial year but Covid-19 impact on garments manufacturing (RMG) lifted the dream.

II. LITERATURE REVIEW

Only a few papers have been published regarding this pandemic situation and the current economic condition of Bangladesh. Because of the current economic disruption everyone being cursed whether businessmen, service holders, students, or unemployed youth. World Bank shows a data TK 500 (USD 5.92) could earn by only 15% population of Bangladesh. On 6 March 2020, the Asian Development Bank (ADB) assumed that the impact of Covid-19 on the economy would be laid off by 894,930 workers in Bangladesh. Data from Kabir Humayun, Maple Myfanwy, and Usher Kim stated that from 13 March to 5 April 2020 14% of the total 2675 respondents weren't having enough food reserve at their home, only 29% had enough food to survive for one to three days. They also pointed out; Covid-19 outbreak warns a potential hunger that could be like the greatest humanitarian crisis since World war-2. Sen Shuvo, Neel Antara, Sen Sushmita, and Chowdhury Sunny ascertained the workers are passing through a crucial time with the financial crisis and they started protesting on the street for their daily remuneration. They also added that the treatment facility is not good enough for the patients. For instance, only 500 Intensive Care Unit (ICU) facility available for approximately 170 Million peoples. So, most people won’t get enough treatment in this pandemic situation. Begum Momotaj, Farid Sarkar, Barua Swarup, and dr. Alam Jahangir Mohammad analyzed the Socio-Economic condition of the Agriculture Sector, Industrial Sector, Service Sector, Health effects, and Education effects. All the major sector has been facing various problems due to Covid-19. The poultry sector worrying to get losses of about tkr1150 crore to sales between 20 March 2020 and 4 April 2020. Bangladesh Poultry Industries Central Council (BPICC) stated that the sale of eggs and chicken has already deteriorated. The commerce minister Tipu Munshi told CNBC news, the world’s second-largest clothing exporter (Bangladesh) has cancelled numerous orders and this could be led to serious problems in the future. The education sector is also widely affected due to this pandemic; on October 7th, 2020 the Bangladesh Govt. has decided there will be no examinations. A total of 1,365,689 students were supposed to seat for the pen and paper Higher Secondary Certificate (H.S.C) exam. Dipu Moni assured that the students will be passed H.S.C exams according to the mean of Junior School Certificate (J.S.C) and the Senior Secondary Certificate (S.S.C) examination’s Grade Point Average (GPA).
To review all the papers it might be right to say Bangladesh needs help from affluent persons and Govt. should put an additional budget on Public expenditure and should decrease the Public revenue to support the corporate sectors and Small and Medium Enterprises (SMEs) in Bangladesh.

III. THE OBJECTIVE OF THE STUDY
The major objective of this study is to give an overview of the Garment Sector in Bangladesh with its evolution and current scenario of economic condition. The main aspects of the Garment Industry and Covid-19 impact on it has been examined and cited with short descriptions:

1. To discuss the Garment Sector’s contribution to Gross Domestic Product (GDP) of emerging Bangladesh.
2. Evolution of the Garment industry in Bangladesh and the rapid escalation of this sector.
4. The economic slowdown of Bangladesh due to the downturn of Revenue of the Garment Sector and unavailability of monetary fund and loan of the garment sectors.
5. The safety issue of the workers, awareness of precautions and Jobless workers rate and their family condition with hunger.
6. A possible solution to the current economic situation.

IV. RESEARCH METHODOLOGY
To understand the forthcoming economic condition and the Covid-19 situation can’t be predicted as the scenario is changing day by day. Thus, the main data has been collected from secondary sources such as various journals, internet, newspaper, and different national & international organizations (BGMEA, EPB, WTO, WHO, IMF, and World Bank). All the data has been presented in Qualitative Methods.

A. Sources of Data
To completion of this report primary and secondary data has been used from different sources.

B. Primary Data
Through physical conversation with the respective officers and the workers of the garment sector.

C. Secondary data
1. Various data sources such as Bangladesh Garment Manufacturers and Exporters Association (BGMEA), International Monetary Fund (IMF), World Bank (WB), Bangladesh Bank (BB), Dhaka stock exchange (DSE), Chattogram Stock Exchange (CSE), Export Promotion Bureau (EPB), etc.
2. Internet browsing through website searching and financial year’s report from various organizations.
3. Authentic published materials books and articles.

D. Analysis of data
Various Tables and Figures have been used for analyzing the collected data and a simple time series analysis is used for demonstrating the trend of export and contribution of export to the GDP in Bangladesh.

V. ANALYSIS AND FINDING
The industrial sector has an emergent role in Bangladesh's economy and contribution to Gross Domestic Product (GDP) is progressively increasing. According to the Bangladesh Bureau of Statistics (BBS), the Industry sector is contributing 31.15 percent for the financial year 2018-2019. There are four major sectors in the industry among the total fifteen national income sources i.e. Quarrying & Manufacturing and Mining, Electricity Gas & Water, and Construction. Among all of the total 15 sources, the manufacturing sector is having the highest contribution to the Economy and the Garments sector is the role model for achieving this remarkable reputation.

In 1960 an entrepreneur launched a garment business as a small tailor named Reaz store at Dhaka. For more than a decade, the tailor started its distribution to the domestic markets. After the independence of Bangladesh (1973), the store has changed its name to M/S Reaz garments Ltd and it started exporting to foreign markets. This Ltd company was the first exporter from Bangladesh to abroad. In 1979 another company came forward, Desh Garment Ltd that was the first non-equity joint venture in the garment industry. By the end of 1982, only 47 garment industries had developed. The garments sector had increased its number to 587 in 1984-1985 and the number reached to 2900 by 1999. Now about 4621 garment factories manufacturing in the domestic market as well as the global market.
There were only 134 Garment factories in 1984, a decade later the Garment industry enlisted its number to 4222. The proliferation of garment industries has led to an increase in the workforce in the garment sector the phenomenal growth in this sector is due to the avid support of the Government and other pioneers. This sector was also naturalized by MFA under the Uruguay Round of GATT in 1994. In Financial Year 2013-2014 the growth rate slowed down due to the crisis of raw materials. Now Bangladesh is one of the major exporter countries all over the world. Most of the garment industries are situated in Dhaka and Chittagong with emphasis on readymade garments (RMG) production. RMG is considered as the economic barometer of the country and its contribution to the GDP almost double with that of agriculture. Bangladesh has achieved a reputation in the international market for its quality of products. According to WTO, Bangladesh has achieved a good reputation in the global market after China, EU (28). These three countries alone contribute 66.6% to the global market.

**TABLE-2: Growth of Garment Factories in Bangladesh**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Garment Factories</th>
<th>Year</th>
<th>Number Of Garment Factories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995-1996</td>
<td>2353</td>
<td>2015-2016</td>
<td>4328</td>
</tr>
<tr>
<td>2001-2002</td>
<td>3618</td>
<td>2016-2017</td>
<td>4482</td>
</tr>
<tr>
<td>2007-2008</td>
<td>4743</td>
<td>2017-2018</td>
<td>4560</td>
</tr>
<tr>
<td>2012-2013</td>
<td>4576</td>
<td>2018-2019</td>
<td>4621</td>
</tr>
</tbody>
</table>

**SOURCE:** Bangladesh Garment Manufacturers and Exporters Association (BGMEA)

**Figure1: Number of RMG workers in Bangladesh (Source: BGMEA)**
TABLE3: Top 10 exporter of clothing 2018 (Billion Dollars)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>158</td>
<td>18.2</td>
<td>26.6</td>
<td>36.6</td>
<td>31.3</td>
<td>-0.4%</td>
</tr>
<tr>
<td>EU (28)</td>
<td>143</td>
<td>28.7</td>
<td>31.0</td>
<td>28.4</td>
<td>28.4</td>
<td>10.6%</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>32</td>
<td>2.6</td>
<td>2.5</td>
<td>4.2</td>
<td>6.4</td>
<td>11.1%</td>
</tr>
<tr>
<td>Vietnam</td>
<td>32</td>
<td>0.9</td>
<td>1.7</td>
<td>2.9</td>
<td>6.2</td>
<td>13.4%</td>
</tr>
<tr>
<td>India</td>
<td>17</td>
<td>3.0</td>
<td>3.1</td>
<td>3.2</td>
<td>3.3</td>
<td>-10.8%</td>
</tr>
<tr>
<td>Turkey</td>
<td>16</td>
<td>3.3</td>
<td>4.2</td>
<td>3.6</td>
<td>3.1</td>
<td>3.8%</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>14</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>-4.4%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>9</td>
<td>2.4</td>
<td>1.8</td>
<td>1.9</td>
<td>1.8</td>
<td>8.7%</td>
</tr>
<tr>
<td>Cambodia</td>
<td>8</td>
<td>0.5</td>
<td>0.8</td>
<td>0.9</td>
<td>1.6</td>
<td>14.0%</td>
</tr>
<tr>
<td>USA</td>
<td>6</td>
<td>4.4</td>
<td>1.8</td>
<td>1.3</td>
<td>1.2</td>
<td>4.9%</td>
</tr>
<tr>
<td>Above 10</td>
<td>435</td>
<td>64</td>
<td>73.5</td>
<td>83</td>
<td>83.3</td>
<td></td>
</tr>
</tbody>
</table>

Source: World Trade Organization (WTO)

Figure 2: Export growth to different markets (Source: BGMEA)

Undoubtedly the garment sector in Bangladesh is the fastest-growing market, being key competitors with China, the EU (28), and Vietnam. Besides, it is evident that Bangladesh is the second leading exporter after China and the growth of export is noteworthy. According to Table-3 Bangladesh alone exported $32 billion garment products to the foreign markets, where China, EU (28) and Vietnam exported $158 billion, $143 billion, $32 billion respectively. Being a small country with less manpower it has achieved a leadership position around the world. Comparison with the past financial years, we have become acquainted every year the export rate has been increasing in the international market.

A. Contribution of Garment Sector to The Economy

The garment sector governs as a major part of the economy in Bangladesh. According to the financial year 2016-2017, the RMG industry exported 80.7% of the total export earnings and contributed 12.36 percent to the GDP. Over the last two decades, the number of factories, manufacturing rate, and contribution to GDP is voluminous. The RMG is having an eminent contribution to the national economy among all of the 15 sectors.
The above figure indicates the contribution of the Garment sector to the Bangladesh economy. The volume of performance to GDP has been increasing from F.Y 1990-91 to 2018-19. In 1991 the participation in the Economy was only 2.744 however, it has been reached 11.17 in 2019 with plenty of conveniences. Consequently, the disbursement of the Garment Sector in the short-run and long-run is observable. But the extensive experience was drafted between 2011 to 2016. It is quite evident that the share of the Garment Sector in the GDP increases every year barring a few. With the prosperity of GDP the Per capita income also pursuing its flow.
B. Impact of Covid-19 on garments sector in Bangladesh

Bangladesh reported its first confirmed coronavirus case on Sunday, 8th March 2020. Two of them were returnee from Italy and the remaining one was the family member of the infected persons. It was the first wave of coronavirus in Bangladesh. Govt ordered to cease all manufacturing activities in the Garment industry in late March as a result, the worker had to move back to their homes.

The major buyers of Bangladesh including American and European fashion firms namely GAP, ZARA, H&M, Primark, Marks & Spencer are slashed their imports and orders due to financial crunch & fall in consumer spending because of the Covid-19. It is assumed that nearly 6 billion order has been cancelled. According to Bangladesh Garment Manufacturers and Exporters Association (BGMEA), 982 million units of garment products which is worth $3.18 billion had already been cancelled. On the other hand, Bangladesh depends heavily on raw materials supplied from China. According to BGMEA 40% of the machinery and spare parts for the RMG are imported from China that accounts for half of the REGULAR IMPORTED RMG raw material. The supply chain of raw materials is severely disrupted due to the unexpected outbreak of CORONAVIRUS.

In June (2020), Only $2.12 billion had been earned for the final month of the immediate past fiscal year. According to Bureau, Customs and Bangladesh Garment Manufacturers and Exporters Association (BGMEA) the earnings were 11.43% lower as compared to the previous year but up 72.4 percent from the previous month. The RMG witnessed a record low in revenues; earnings from the sector stood only $0.37 billion, the lowest since triggered booming occurred four decades ago. The following TABLE-3 shows export performance and growth rate of Financial Year 2019-2020.

<table>
<thead>
<tr>
<th>Month</th>
<th>Export Performance</th>
<th>Growth Rate</th>
<th>Month</th>
<th>Export Performance</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>3,310</td>
<td>9.7%</td>
<td>January</td>
<td>3039</td>
<td>-2.98%</td>
</tr>
<tr>
<td>August</td>
<td>2,406</td>
<td>-11.46%</td>
<td>February</td>
<td>2784</td>
<td>-4.48%</td>
</tr>
<tr>
<td>September</td>
<td>2,341</td>
<td>-4.7%</td>
<td>March</td>
<td>2256</td>
<td>-20.14%</td>
</tr>
<tr>
<td>October</td>
<td>2520</td>
<td>-19.79%</td>
<td>April</td>
<td>374</td>
<td>-85.25%</td>
</tr>
<tr>
<td>November</td>
<td>2511</td>
<td>-11.98%</td>
<td>May</td>
<td>1230</td>
<td>-62.06%</td>
</tr>
<tr>
<td>December</td>
<td>2935</td>
<td>1.26%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Export Promotion Bureau (EPB)

C. Time Series Analysis
The indirect method of time series analysis has been used to expose the trend of Garment sector export by using 11 months of data. Here,

\[ P=\text{constant} \]
\[ Q=\text{slope} \]
\[ Y=\text{Dependent variable} \]
\[ t=\text{Time} \]

\[ Y=a + b*t \]
Table 5: Garment Sector Export Trend

<table>
<thead>
<tr>
<th>Months</th>
<th>Export (Y) (mill$)</th>
<th>Time (t)</th>
<th>Y*t</th>
<th>t²</th>
</tr>
</thead>
<tbody>
<tr>
<td>July</td>
<td>3,310</td>
<td>-5</td>
<td>-16,550</td>
<td>25</td>
</tr>
<tr>
<td>August</td>
<td>2,406</td>
<td>-4</td>
<td>-9,624</td>
<td>16</td>
</tr>
<tr>
<td>September</td>
<td>2,341</td>
<td>-3</td>
<td>-7,023</td>
<td>9</td>
</tr>
<tr>
<td>October</td>
<td>2,520</td>
<td>-2</td>
<td>-5,040</td>
<td>4</td>
</tr>
<tr>
<td>November</td>
<td>2,511</td>
<td>-1</td>
<td>-2,511</td>
<td>1</td>
</tr>
<tr>
<td>December</td>
<td>2,935</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>January</td>
<td>3,039</td>
<td>1</td>
<td>3,039</td>
<td>1</td>
</tr>
<tr>
<td>February</td>
<td>2,784</td>
<td>2</td>
<td>5,568</td>
<td>4</td>
</tr>
<tr>
<td>March</td>
<td>2,256</td>
<td>3</td>
<td>6,768</td>
<td>9</td>
</tr>
<tr>
<td>April</td>
<td>374</td>
<td>4</td>
<td>1,496</td>
<td>16</td>
</tr>
<tr>
<td>May</td>
<td>1,230</td>
<td>5</td>
<td>6,150</td>
<td>25</td>
</tr>
<tr>
<td>n=11</td>
<td>ΣY=25,706</td>
<td>ΣY*t=(17,727)</td>
<td>Σt=110</td>
<td></td>
</tr>
</tbody>
</table>

Now, 
\[ P = \frac{\sum Y}{n} = \frac{25,706}{11} = 2337 \]
\[ Q = \frac{\sum Y*t}{\sum t^2} = \frac{-17,727}{110} = -1612 \]

So, the Export business equation is:
\[ Y = 2337 + (-1612) * t \]

We can draw the conclusion that Covid19 brought a catastrophic impact on the Bangladesh Garment Sector sector. This pandemic has not only disrupted economic activities but also caused a migrant crisis. Thousands of workers lost their job due to deficient production and 2.28 million workers (Source: BGMEA) have tested positive. Around 850 factories are operating with fewer workers due to inadequate facilities for maintaining social distancing. They are vulnerable to getting infected while they are being recalled to report for work in these unprecedented times.

On the contrary, if the garment factories remain shut and the owners were too asked to pay the salaries in full, it would be unsustainable which will further cripple the industry. This is a pressing concern that needs to be addressed before the situation goes beyond control. The owners, therefore, have decided to continue their operations in a staggered manner and pay the workers for the work done accordingly instead of having to pay the workers without any production, which seems more pragmatic. So accordingly, the Government, Employers, and workers are cooperating to cope up with this challenging scenario and find a middle ground. If such is not the case, there would-be large-scale unemployment which would eventually push people towards poverty and hunger. About 21.8% of people live under the poverty line in Bangladesh. The percentage is likely to increase manifold if people remain out of work. In March 2020, $500 million has been announced as a relief package to the garment sector by the Government, and later it has been increased to $8 Billion.

After months of lockdown economies of the EU, the USA, China and other countries are opening up slowly. Some retailers and other brands have decided to keep their shops open to facilitate some inflow of orders to the Garment sectors. The international orders are picking up in Bangladesh. Government has taken steps to oversee that the garment sectors reopen in phases so that the previous obligation of the buyers are honoured. Accordingly, the workers are coming back to the factories for work. the International Labour Organization (ILO) noted this development in Bangladesh and has urged the Government to maintain working conditions conforming to the safety norms in Covid-19 because there is always an imminent risk of spreading the virus in workplaces.
VI. CONCLUSION

The outbreak of Coronavirus and its impact on the garment sectors of Bangladesh has been stated. There is no conclusive evidence to determine the lifespan of COVID-19 on various surfaces (Such as Metal, Glass, Plastic) and the long-term impact on the person who has recovered is also not clear. Since it is possible for the virus to spread through the workers if they get infected (both symptomatic and asymptomatic) Bangladesh has taken some immediate measures guided by the World Trade Organization (WTO), International Labour Organization (ILO), Global health Communities, BGMEA, to adhere to the guidelines of the World Health Organization (WHO) especially to break the chain of transmission. After months of lockdown and other restrictions to curb the virus spread, various restrictions are gradually lifted except for educational institutions. Businesses are opening in a steady manner conforming to the prescribed safety measures.


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COMPARISON OF SYMMETRIC AND ASYMMETRIC GARCH MODELS IN THE FUTURES CONTRACT OF ROBUSTA COFFEE IN JAKARTA FUTURES EXCHANGE

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Abstract- Futures exchange is growing rapidly in various countries and has become one of the supports for the economic development of the country. However, research on investment in this field in Indonesia is limited. This study compares the symmetric and asymmetric GARCH models to investigate the volatility of the futures price data of Robusta coffee in the Jakarta Futures Exchange. It used the GARCH, EGARCH, and GJR-GARCH models. Meanwhile, the data used were robusta coffee prices, covering spot prices, March contract prices, and September contract price for the 2016-2019 period. The results of the study indicate that the GARCH (1,1) is the most suitable model for the three Robusta coffee prices.

Index Terms- Futures, Robusta Coffee, GARCH, Asymmetric GARCH

I. INTRODUCTION

A futures exchange is a place that facilitates the sale and purchase of futures contracts for a number of agricultural, plantation, mining, and other types of commodities at a predetermined price and at a specified time in the future for the delivery (Hull, 2008). In the futures market, trading is based on a standardized contract called a futures contract. In the futures exchange, there are two important roles, namely the hedger and the speculator. The hedger group is the party that takes advantage of the existence of a futures exchange to manage risks due to price fluctuations of the commodities. Meanwhile, the speculator group is the party that takes advantage of commodity price fluctuation on the stock exchange for profit. Predicting in this futures market can result either in profit or loss. The potential profit of the speculation is proportional to the risks that have to be faced, depending on the skill of the speculator in predicting price fluctuation.

In the financial sector, there are many time series that have high volatility and diversity which differ at each point in time. According to (Enders, 1995), time-series data with non-constant variations are called time series data with heteroscedasticity. It can be solved using the Autoregressive Conditional Heteroscedastic (ARCH) model. The ARCH model was introduced by Engle (1982). This model was later developed by Bollerslev (1986) and called the GARCH model. Several studies on economic data indicate that returns have asymmetric volatility in which there are differences in volatility movements towards an increase or decrease in asset prices. Research conducted by Arifin et al (2017) on data on three stock assets in Indonesia using the GARCH and EGARCH models showed that the EGARCH model was better. Another study by Julia et al (2018) revealed the comparison of the GARCH model and some asymmetric EGARCH models, namely EGARCH and TGARCH for modeling the return of the Composite Stock Price Index (IHSG). It showed that the asymmetric GARCH model is better than the GARCH model. Therefore, the researcher is interested in applying the symmetrical and asymmetric GARCH models in the case of the futures exchange in Indonesia.

Jakarta Futures Exchange (JFX) is the first futures exchange in Indonesia. One of the commodities currently dominating the transactions at JFX is Robusta Coffee. Indonesia is the 4th world's largest coffee producer after Brazil, Vietnam, and Colombia. Besides, the increase in popularity of the coffee business will increase the coffee trade between farmers and traders or coffee entrepreneurs which can attract more investors. Therefore, the researcher is interested in using the commodity price data of robusta coffee in JFX. This study aims to compare the symmetric and asymmetric GARCH models to investigate the volatility of the futures price data for the Robusta coffee in the Jakarta Future Exchange. It used the GARCH, EGARCH, and GJR-GARCH models.
II. MATERIALS AND METHODS

2.1 Return

Investors invest to get return assets from the results of the investment. According to (Tsay, 2010), suppose $P_t$ represents the asset price at time $t$, then to find the log return if $P_t$ represents the asset price at time $t$, the log return can be calculated with the following equation:

$$R_t = \ln(1 + R_t) = \ln \frac{P_t}{P_{t-1}} = \ln P_t - \ln P_{t-1}$$

$P_{t-1}$ shows the asset price at the end of the period $t-1$.

2.2 Stationary Test

Stationer time series data have a constant mean and variance (Cryer, 2008). One of the data stationary tests is the Augmented Dickey-Fuller (ADF) test. The model to be tested is:

$$\Delta Y_t = \alpha Y_{t-1} + \phi_1 \Delta Y_{t-1} + \cdots + \phi_k \Delta Y_{t-p} + \epsilon_t + \epsilon_t$$

$Y_t$ represents the time series data in the $t$-period and $k$ lag order of the auto-regression process. The Dickey-Fuller test has the following hypothesis.

$H_0 : \alpha = 0$ or non-stationary data

$H_1 : \alpha < 0$ or stationary data

Statistics Test

$$\tau^* = \frac{\hat{\alpha}}{se(\hat{\alpha})}$$

If the value of $|\tau^*|$ is higher than the critical value of $\tau$ Dickey-Fuller with the degree of freedom (n) and significance level ($\alpha$), then, $H_0$ is rejected, thus it can be said that the data are stationary.

2.3 Autoregressive Integrated Moving Average (ARIMA)

The identification of the ARIMA model $(p, d, q)$ was performed after the data are stationary. If the data are not differencing (the data have been stationary), then $d$ will be 0 and if the data become stationary after the first differencing, then $d$ will be 1 and so on. Cryer (2008) formulates some general ARIMA models:

a. ARIMA Model $(0,0,q)$ or MA(q)

$$Y_t = \epsilon_t - \theta_1 \epsilon_{t-1} - \theta_2 \epsilon_{t-2} - \cdots - \theta_q \epsilon_{t-q}$$

b. ARIMA Model $(p,0,0)$ or AR(p)

$$Y_t = \phi_1 Y_{t-1} - \phi_2 Y_{t-2} - \cdots - \phi_p Y_{t-p} + \epsilon_t$$

c. ARIMA Model $(p,0,q)$ or ARMA(p, q)

$$Y_t = \phi_1 Y_{t-1} - \phi_2 Y_{t-2} - \phi_p Y_{t-p} + \epsilon_t - \theta_1 \epsilon_{t-1} - \theta_2 \epsilon_{t-2} - \cdots - \theta_q \epsilon_{t-q}$$

where:

$\phi$ = autoregressive parameter

$\theta$ = moving average parameter

$p$ = autoregressive level

$q$ = moving level

$\epsilon_t$ = residual

2.4 Ljung-Box Test

The Ljung-Box test is an error autocorrelation test of the ARMA model that has been formed. The test hypothesis covers:

$H_0 : \rho_1 = \rho_2 = \cdots = \rho_k = 0$ (there is no autocorrelation)

$H_1 : \text{at least one } \rho_k \neq 0 \text{ for } k = 1,2,\ldots,k$ (there is autocorrelation)

Statistic Test

$$Q = n(n+2) \sum_{k=1}^{k} \frac{\epsilon_k^2}{n-k}$$
The decision on the residual autocorrelation hypothesis is if the value of $Q \leq X^2_{(α,k−p−q)}$ at the significance level of $α$ or the p-value of the Q test statistic is higher than the $α$ value, then H is not rejected meaning that there is no autocorrelation.

2.5 Heteroscedasticity Test

The time series model covers an error process which is usually denoted by $ε_t$. One of the assumptions that should be met is the assumption of homoscedasticity in which variance of the residuals does not change with changes in one or more independent variables. Meanwhile, if the residual variance is not constant, the residual is heteroscedasticity. The AutoRegressive Conditional Heteroscedasticity-Lagrange Multiplier (ARCH-LM) test is to determine the presence of heteroscedasticity effects on data.

If $ε_t = X_t − μ_t$ is the error of the mean equation, then $ε_t^2$ is to check the heteroscedasticity or ARCH effect. This test is the same as the F statistics in the linear regression.

$$ε_t^2 = α_0 + α_1 ε_{t−1}^2 + ... + α_p ε_{t−L}^2 + w_t$$

$T$ represents the number of observations and $w_t$ is the error. The hypothesis of the ARCH-LM test is as follows:

$H_0 : α_0 = α_1 = ... = α_p = 0$ (no ARCH effect)

$H_1$: at least one $α_k \neq 0, k = 0,1,2,...,p$ (there is an ARCH effect)

2.6 Generalized Autoregressive Conditional Heteroscedasticity (GARCH)

Financial time series data such as stock price index, return assets, exchange rates, and others tend to fluctuate from time to time. This fluctuation makes the data variability relatively high and time-varying variance. One of the models that can be used is the Autoregressive Conditional Heteroscedasticity (ARCH) model. This model was then developed into Generalized Autoregressive Conditional Heteroscedasticity (GARCH). The GARCH model $(p,q)$ can be seen below (Montgomery et.al, 2007).

$$σ_t^2 = α_0 + \sum_{i=1}^{p} β_i σ_{t−i}^2 + \sum_{j=1}^{q} α_j ε_{t−j}^2$$

$σ_t^2$ is conditional variance, $α_j$ and $ε_{t−j}^2$ are components of ARCH, $β_i$ and $σ_{t−i}^2$ are components of GARCH. In the GARCH model $(p,q)$, $ε_t$ is generated by the process of $ε_t = z_t σ_t$ where $σ_t$ the positive root of $σ_t^2$ and $z_t$ is the iid process (independent and identically distributed).

2.7 Asymmetric GARCH

The weakness of the GARCH model is that it cannot capture asymmetric effects. The asymmetric effect is the difference in the changes in volatility when there is a movement in the return value. Some models have been developed to overcome the weaknesses of GARCH including the Exponential GARCH which was introduced by Nelson in 1991. The EGARCH model is expressed in the following equation.

$$log(σ_t^2) = \omega + \sum_{i=1}^{p} β_i ln(σ_{t−i}^2 + \sum_{j=1}^{q} α_j |z_{t−j}| + \sum_{j=1}^{q} γ_j z_{t−j}$$

The GJR-GARCH model was proposed by Glosten et al. in 1993 as cited by:

$$σ_t^2 = \omega + \sum_{i=1}^{p} β_i σ_{t−i}^2 + \sum_{j=1}^{q} α_j ε_{t−j}^2 + \sum_{j=1}^{q} γ S_j^− ε_{t−j}^2$$

where $S_j^−$ is a dummy variable which has a value of 1 if $ε_{t−j}$ is negative and 0 if $ε_{t−j}$ is positive. The asymmetric effect can be detected by looking at the coefficient $γ$ on the asymmetric GARCH model. The resulting coefficient $γ \neq 0$ showed a significant asymmetric effect (Dutta, 2014).

2.8 Best Model Criteria

In data analysis, commonly some models can represent data. One of the best models among them is selected with several criteria based on error analysis and forecast. One of the error analysis is Akaike Info Criterion (AIC). Meanwhile, based on the forecast, it can use Mean Absolute Deviation (MAD), Mean Square Error (MSE), and Root Mean Square Error (RMSE).

1. Akaike Info Criterion (AIC)

$$AIC = −2 ln(\hat{θ}) + 2k$$

der dengan
\[ l = - \frac{R}{2} \left[ 1 + \log(2\pi) + \log\left( \frac{e'}{R} \right) \right] \]

2. Mean Absolute Deviation
\[ \text{MAD} = \frac{1}{T} \sum_{t=1}^{T} |Y_t - \hat{Y}_t| \]

3. Mean Square Error
\[ \text{MAPE} = \frac{1}{T} \sum_{t=1}^{T} \left( \frac{Y_t - \hat{Y}_t}{Y_t} \right)^2 \]

4. Root Mean Square Error
\[ \text{RMSE} = \sqrt{\frac{1}{T} \sum_{t=1}^{T} (Y_t - \hat{Y}_t)^2} \]

where \( T \) = number of data, \( Y_t \) = actual data, \( \hat{Y}_t \) = predicted data. The model is better if the statistic value of AIC, MAD, MSE, and RMSE is smaller.

2.10 Data

This study used daily close price data of the Robusta coffee commodity on the Jakarta Futures Exchange from January 4, 2016, through December 31, 2019. The data covered spot price and contract price data of March and September contracts. Data in the period January 4, 2016 - December 20, 2019, were used to obtain the best modeling, while data in the period of December 21, 2019 - December 31, 2019, were for model validation.

III RESULT

3.1 Data Exploration

This study used daily close price data of the Robusta coffee commodity on the Jakarta Futures Exchange from January 4, 2016, to December 20, 2019. It used a total of 1448 data consisting of three types of Robusta coffee prices, namely the spot price, March contract price, and September contract price.

![Figure 1 Plot of Robusta Coffee Closing Price](image)

Based on Figure 1, the robusta coffee closing price plot showed up and down trends. Based on the two plots, the pattern tends to be the same in which it started to increase in early 2017 and decreased in early 2018. Based on the Statistics of Indonesian Coffee Commodities in 2016, the coffee land damages in 2018 reaching 158,593 hectares (ha) of the total land area of 1.25 million ha. This may be the cause of the decline in robusta coffee prices in 2018. Then, the return of the daily closing price data was calculated. The descriptive statistics and plots of the Robusta spot return and contract can be seen below.

| Table 1 Descriptive statistics of robusta coffee price return |
|---------------------------------|----------------|----------------|----------------|
| Return                         | Spot           | March          | September      |
| Mean                           | -0.000076      | -0.000076      | -0.000086      |
| Min.                           | -0.08588       | -0.1107        | -0.08512       |
| Max.                           | 0.09574        | 0.07505        | 0.09511        |
| Skewness                       | -0.09807       | -0.54896       | 0.3661         |
| Kurtosis                       | 8.46983        | 7.60895        | 8.257441       |
| Kolmogorov-Smirnov             | 0.0000*        | 0.000*         | 0.000*         |

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Based on Table 1, the mean value of the return spot and March contract is higher than that of the September contract. The negative skewness value on the return spot and March contract indicated that the data distribution was the long left tail. Meanwhile, the September contract return was positive, so it has a long right tail. Then, the three returns have a kurtosis value that is not equal to 3. Therefore, based on the skewness and kurtosis values, it illustrates the asymmetry of the normal distribution. These results are supported by the Kolmogorov-Smirnov test result which produces a p-value of less than 5%.

Figure 2 is a plot of the return spot and the two contract returns. The plot of the return spot can be used to identify the stationary data. Data are stationary if the observed data do not have a certain movement pattern, or do not contain a trend. Figure 2 shows that there are no more up or down trends. Stationary can be tested using the Augmented Dickey-Fuller (ADF) test. The result of the ADF Test is presented in Table 2.

<table>
<thead>
<tr>
<th>Robusta</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot</td>
<td>0.01</td>
</tr>
<tr>
<td>March</td>
<td>0.01</td>
</tr>
<tr>
<td>September</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 2 shows the result of the data stationary test using the Augmented Dickey-Fuller (ADF) test. Based on the ADF test, the three data were stationary at the significance level of 5%. After the return is declared stationary, the next step is the ARMA modeling.

3.2 ARIMA Model

The initial model used for this study was the ARMA model. The selection of candidate models was based on the order simulation from the ACF and PACF plots. The selected ARIMA model is the one with the smallest AIC value and significance coefficient. Besides, some additional models would be tested for compatibility, where the order p and q were obtained through a trial and error process. Based on those considerations, the best model for each robusta price is as follows:

<table>
<thead>
<tr>
<th>Robusta</th>
<th>Model</th>
<th>Parameter</th>
<th>Estimation</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot</td>
<td>ARIMA (2,0,4)</td>
<td>AR(1)</td>
<td>-0.99028</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>ARMA</td>
<td>AR(2)</td>
<td>-0.67868</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(1)</td>
<td>1.0306</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(2)</td>
<td>0.49894</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(3)</td>
<td>-0.2599</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(4)</td>
<td>-0.16837</td>
<td>0.001</td>
</tr>
<tr>
<td>March</td>
<td>ARIMA (0,0,3)</td>
<td>MA(1)</td>
<td>0.089001</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>ARMA</td>
<td>MA(2)</td>
<td>-0.19721</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MA(3)</td>
<td>-0.11281</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Based on table 3, the best ARIMA model for robusta spot is ARIMA (2,0,1). While the best model for March and September were ARIMA (0,0,3) and ARIMA (2,0,4) respectively. Then, the ARCH LM test was carried out to see heteroscedasticity in the remain model. The null hypothesis of the ARCH LM test is that there is no heteroscedasticity in the remain model.

Table 4 The Result of ARCH-LM test

<table>
<thead>
<tr>
<th>Lag</th>
<th>Spot</th>
<th>March</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Based on Table 4, the result of the heteroscedasticity test at lag 1 - 6 showed a very small p-value. P-value which is smaller than the significance level of 5% means that the null hypothesis is rejected. It means there is heteroscedasticity in the remain models. Heteroscedasticity in the remain of the ARIMA model can be solved using the GARCH model and asymmetric GARCH model.

3.3 GARCH Model

The process of selecting the best GARCH model was carried out by combination simulation of predetermined orders, namely GARCH (1,1), GARCH (1,2), GARCH (2,1), and GARCH (2,2). The ARCH/GARCH model selection was based on the AIC value of each model and the significance of the parameters. The results of the GARCH model for each robusta can be seen in Table 5.

Table 5 The best GARCH model

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Spot</th>
<th>March</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GARCH(1,1)</td>
<td>GARCH(1,1)</td>
<td>GARCH(1,1)</td>
</tr>
<tr>
<td>(\omega)</td>
<td>0.000066</td>
<td>0.000064</td>
<td>0.000068</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>(\alpha_1)</td>
<td>0.387601</td>
<td>0.408370</td>
<td>0.485760</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>(\beta_1)</td>
<td>0.257507</td>
<td>0.129625</td>
<td>0.107781</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.009)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>AIC</td>
<td>-6.0311</td>
<td>-6.2568</td>
<td>-6.1739</td>
</tr>
</tbody>
</table>

Based on the significance of the parameters and the smallest AIC, the best GARCH model for robusta is GARCH (1,1). Table 5 shows the predicted values for the GARCH model parameters (1,1) for robusta spot, march, and september. All parameter values were less than 5%. The result of the residual test on the three selected models showed no autocorrelation and heteroscedasticity.

3.4 Asymmetric GARCH

The GARCH model assumes that there is no difference in the effect of volatility when there is a negative or positive movement. There was an indication that returns have asymmetric volatility. Thus, to detect an asymmetric effect on the return volatility behavior, several GARCH asymmetric models are specified with the best order model that has been obtained in the symmetric model. They were EGARCH and GJR-GARCH models in which the best asymmetric GARCH model with the smallest AIC criteria would be selected.
Table 6 The Best Asymmetric Model

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Spot GJR-GARCH(1,1)</th>
<th>March EGARCH(1,1)</th>
<th>September EGARCH(1,1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \omega )</td>
<td>0.00007 (0.000)</td>
<td>-5.959710 (0.000)</td>
<td>-5.759374 (0.000)</td>
</tr>
<tr>
<td>( \alpha_1 )</td>
<td>0.47627 (0.000)</td>
<td>0.009153 (0.000)</td>
<td>-0.018357 (0.616)</td>
</tr>
<tr>
<td>( \beta_1 )</td>
<td>0.164695 (0.000)</td>
<td>0.340790 (0.000)</td>
<td>0.357774 (0.000)</td>
</tr>
<tr>
<td>( \gamma )</td>
<td>0.012616 (0.913)</td>
<td>0.712626 (0.000)</td>
<td>0.0847718 (0.000)</td>
</tr>
<tr>
<td>AIC</td>
<td>-6.0494</td>
<td>-6.2723</td>
<td>-6.2348</td>
</tr>
</tbody>
</table>

Table 6 shows the most appropriate estimation result of the asymmetric model. The coefficient \( \gamma \) indicates the presence of an asymmetric effect. It showed the estimated value of \( \gamma \neq 0 \) with positive and significant at the significance level of 5% for March and September. Meanwhile, the spot is not significant at the 5% level. Then, based on the residual test, the three models have no autocorrelation and heteroscedasticity up to the 6th lag.

3.5 Selection of the Best Model

Based on the result of the study, the symmetric GARCH model presents a better model than the asymmetric GARCH model. It can be seen from the significance level of the parameters. The objective of the selected model is for simulation, so it requires a good model in terms of forecasting. Therefore, model validation was carried out by calculating the MAD, MSE, and RMSE values. The data used for validation were data from the period of December 21, 2019, to December 31, 2019. The comparison result of the MAD, MSE, and RMSE values can be seen in the following table.

Table 7 Summary of the Validation Result

<table>
<thead>
<tr>
<th>Robusta</th>
<th>Model</th>
<th>MAD</th>
<th>MSE</th>
<th>RMSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spot</td>
<td>GARCH(1,1)</td>
<td>0.0280</td>
<td>0.0012</td>
<td>0.0350</td>
</tr>
<tr>
<td></td>
<td>GJR-GARCH(1,1)</td>
<td>0.0284</td>
<td>0.0013</td>
<td>0.0357</td>
</tr>
<tr>
<td>March</td>
<td>GARCH(1,1)</td>
<td>0.0072</td>
<td>0.0001</td>
<td>0.0098</td>
</tr>
<tr>
<td></td>
<td>EGARCH(1,1)</td>
<td>0.0074</td>
<td>0.0001</td>
<td>0.0099</td>
</tr>
<tr>
<td>September</td>
<td>GARCH(1,1)</td>
<td>0.0685</td>
<td>0.0098</td>
<td>0.0988</td>
</tr>
<tr>
<td></td>
<td>EGARCH(1,1)</td>
<td>0.0687</td>
<td>0.0098</td>
<td>0.0988</td>
</tr>
</tbody>
</table>

Based on the table above, the validation result for robusta spot showed that the MAD, MSE, and RMSE value of the GARCH(1,1) is smaller than GJR-GARCH (1,1). Then, in the march contract, the MAD and RMSE value in GARCH (1,1) is smaller than EGARCH (1,1). Similar to the september contract, the MAD value on GARCH (1,1) is smaller than MAD value of the EGARCH (1,1). Therefore, the best model based on validation in forecasting for robusta spot returns, march contracts, and september contracts is the GARCH (1,1).

IV CONCLUSION

The high fluctuation of the return data results in the residual of the ARMA model with autocorrelation and non-homogeneous. To solve this problem, simultaneous modeling was carried out using the ARMA model for its mean function and using GARCH/EGARCH/GJR-GARCH model for its conditional variance function. The selected model was then obtained by looking at the significance of the parameters and the validation. The selected model for the spot price, March contract, and September contract is the GARCH (1,1).

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Differences of Electrolytes Value in Pre and Post Percutaneous Nephrolithotomy (PCNL) In Nephrolithiasis Patients in RSUP H. Adam Malik Medan

M. Bob Muharly Rambe*, Dhirajaya Dharma Kadar**, Ramlan Nasution**

* Department of Surgery, Adam Malik General Hospital Medan, Indonesia
**Department of Surgery, Urology Division, Adam Malik General Hospital Medan, Indonesia

Abstract- Percutaneous nephrolithotomy (PCNL) is the treatment of choice for kidney stones. In the PCNL procedure, artificial occlusion of the pelvic system and irrigation were performed. Although the irrigation process is performed with isotonic fluids, the PCNL procedure carries a risk of intravascular absorption of fluid. Apart from affecting hemodynamics, this can affect the amount of electrolytes before and after PCNL. The purpose of this study is to determine the difference between serum electrolytes in the conditions before and after the Percutaneous Nephrolithotomy (PCNL) procedure. This research is an analytical study with a cross-sectional design. Samples were taken using consecutive sampling technique according to the inclusion criteria in patients who had undergone Percutaneous Nephrolithotomy (PCNL) in RSUP Haji Adam Malik Medan, as many as 47 people. Data were taken from February to June 2020. The results showed that the sodium value before and after PCNL has a mean difference of 1.90, so that the p value> 0.05, which means not statistically significant. It is also known that the value of potassium before and after PCNL has a mean difference of 0.47, so that the p value> 0.05, which means not statistically significant. The chloride value before and after PCNL had a mean difference of 0.45, so the p value was > 0.05, which means not statistically significant. In conclusion, there is no difference between electrolyte levels before and after PCNL based on the duration of action.

Keywords- PCNL, Electrolytes, Nephrolithiasis, Indonesia

I. INTRODUCTION

Urinary tract stones are a common problem that is often found in society. This can be found in all countries with prevalence rates varying from 5% to 15%. The prevalence of urinary tract stones is also increasing in adult and pediatric populations worldwide.1

Based on the Basic Health Research (Riskesdas) in 2013, the prevalence of kidney stones based on interviews increased with age, the highest was in the 55-64 years age group (1.3%), decreased slightly in the 65-74 years age group (1.2%) and age ≥75 years (1.1%). The prevalence is higher in men (0.8%) than in women (0.4%).1

In dealing with kidney stones, various procedures can be performed, including open surgery and Percutaneous Nephrolithotomy (PCNL). As time went by, PCNL is in great demand because it has the advantages of being minimally invasive and relatively cheap compared to open surgery. PCNL also has clear indications and has a good trend.1

In the PCNL procedure, artificial occlusion of the pelvic system and irrigation were performed. The goal is to make it easier to perform the puncture and prevent fragments of rock from entering the ureter. In addition, irrigation is carried out to facilitate visibility. Although the irrigation process is carried out with isotonic fluids, the PCNL procedure does carry the risk of intravascular absorption of fluid. Plasma fluid consists of water (91-92%) and solid parts (8-9%), electrolytes such as sodium, potassium, bicarbonate, chloride and calcium are one part of plasma fluid (Mathew, et al 2019). In the study conducted by Xu et al, there were changes in sodium, potassium and chloride just before PCNL and 24 hours after PCNL. From 34 patients who received PCNL, the sodium levels decreased from 140.0 mEq / L to 138.6 mEq / L. Decrease in Potassium levels from 4.2 mEq / L to 4.1 mEq / L. Decreased levels of chloride actually from 103.8 mEq / L to 104.8 mEq / L.1

Pan et al also conducted a pre- and post-PCNL study on sodium and potassium levels. In sodium there is an increase in the amount of sodium from 138.0mEq / L to 143.0 mEq / L. While for potassium there was a decrease from 3.5mEq / L to 3.45 mEq / L.2

II. METHODS

This research is an analytical study with a cross-sectional design. The data source comes from secondary data obtained from medical records to determine the sample to match the inclusion and exclusion criteria in patients who have undergone Percutaneous Nephrolithotomy (PCNL) at Haji Adam Malik Hospital Medan.

The research was conducted at the Department of Surgery, Division of Urology, Faculty of Medicine, University of North
Sekar et al

III. RESULTS

From total of 47 patients sampled, 26 (55.3%) were male patients and 21 (44.7%) were female patients. From the research data it is known that there were 20 (42.6%) patients who had PCNL on the right side and 27 (57.4%) on the left side. The mean values of sodium, potassium and chloride before PCNL were 135.72 ± 5.97, 3.79 ± 0.76 and 103.74 ± 3.37, respectively. Meanwhile, the average values of sodium, potassium, and chloride after PCNL were 134.17 ± 4.42, 3.61 ± 0.57 and 103.49 ± 3.24. While the duration of the PCNL operation, 19 patients (40.4%) were done in less than 2 hours and 28 patients (59.6%) were done more than 2 hours.

Table 1. Demographic Characteristics of Samples

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>26 (55.3)</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>21 (44.7)</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before PCNL (mEq / L)</td>
<td>135.72 ± 5.97</td>
<td></td>
</tr>
<tr>
<td>After PCNL (mEq / L)</td>
<td>134.17 ± 4.42</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before PCNL (mEq / L)</td>
<td>3.79 ± 0.76</td>
<td></td>
</tr>
<tr>
<td>After PCNL (mEq / L)</td>
<td>3.61 ± 0.57</td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before PCNL (mEq / L)</td>
<td>103.74 ± 3.37</td>
<td></td>
</tr>
<tr>
<td>After PCNL (mEq / L)</td>
<td>103.49 ± 3.24</td>
<td></td>
</tr>
<tr>
<td>PCNL action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>20 (42.6)</td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>27 (57.4)</td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 2 hours</td>
<td>19 (40.4)</td>
<td></td>
</tr>
<tr>
<td>≥ 2 hours</td>
<td>28 (59.6)</td>
<td></td>
</tr>
<tr>
<td>Bleeding</td>
<td>90 (5 - 250)</td>
<td></td>
</tr>
</tbody>
</table>

From the data in table 2 below, it is known that the sodium value before and after PCNL has a mean difference of 1.90 with CI 95% -0.13 - 3.95, so that the p value> 0.05 means that it is not statistically significant. It is also known that the value of potassium before and after PCNL has a mean difference of 0.47 with a CI 95% -0.19 - 1.13, so that the p value> 0.05, which means that it is not statistically significant. From table 2.3 it is also known that the chloride value before and after PCNL has a mean difference of 0.45 with CI 95% -0.68 - 1.59, so that the p value> 0.05, which means that it is not statistically significant. It can be concluded that the values of sodium, potassium and chloride before and after PCNL were not statistically significant.

Table 2. Difference in electrolytes of sodium, potassium, and chloride before and after PCNL with a duration of operation <2 hours (n = 19)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before</th>
<th>After</th>
<th>Mean diff. (95% CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mEq / L</td>
<td>135.91 ± 5.87</td>
<td>134.00 ± 5.32</td>
<td>1.90 (-0.13-3.95)</td>
<td>0.064</td>
</tr>
<tr>
<td>Potassium</td>
<td>mEq / L</td>
<td>4.08 ± 0.80</td>
<td>3.60 ± 0.16</td>
<td>0.47 (-0.19-1.13)</td>
</tr>
<tr>
<td>Chloride</td>
<td>mEq / L</td>
<td>102.36 ± 2.33</td>
<td>101.91 ± 1.64</td>
<td>0.45 (-0.68-1.59)</td>
</tr>
</tbody>
</table>

In Table 3, the comparison of sodium levels before and after the action was compared to the right or left PCNL action. On the right PCNL, it was found that the mean difference in sodium level was 2.0 with CI 95% -1.47-5.47 so that the p value was> 0.05, which means that there was no statistically significant relationship. The left PCNL action was also performed a comparison which resulted in the mean difference value of 1.22 with CI 95% -0.38-2.83 which has a value of p> 0.05 so that there is no statistically significant difference. So that sodium levels have no difference with either right or left PCNL action.

Table 3. Comparison of Sodium to PCNL Action

<table>
<thead>
<tr>
<th>Action</th>
<th>Sodium levels</th>
<th>Mean Difference</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
<td></td>
</tr>
<tr>
<td>PCNL</td>
<td>136.55± 5 ±14</td>
<td>134.55± 5</td>
<td>2.00 (-</td>
</tr>
<tr>
<td>Right</td>
<td>(n = 20)</td>
<td>mEq / L</td>
<td>mEq / L</td>
</tr>
<tr>
<td>Left</td>
<td>135.11± 5 ±14</td>
<td>133.89</td>
<td>1.22 (-</td>
</tr>
<tr>
<td>(n = 27)</td>
<td>mEq / L</td>
<td>mEq / L</td>
<td>mEq / L</td>
</tr>
</tbody>
</table>

IV. DISCUSSIONS

In the treatment of kidney stones, there are several actions that can be chosen, depends on its classification, one of which is percutaneous nephrolithotomy (PCNL). In its implementation, irrigation fluid is used to make it easier to puncture and prevent stone fragments from entering the ureter, but this has the risk of absorption of fluid intravascularly so that it can interfere with electrolytes, hemodynamics and metabolic changes in PCNL patients.

In this study, various characteristics were obtained from the processed sample, from a total of 47 patients tested, 26 (55.3%) were male and 21 (44.7%) were female patients. The same thing was also found in a study conducted by Sekar et al. (2018), most of the subjects were men (n = 25, 62.50%) followed by women (n = 15, 37.50%). Based on the location of the kidneys performed by PCNL, 20 (42.6%) were right kidneys and 27 (57.4%) were left kidneys. In contrast, in a
study showed that with 142 kidney units, PCNL was performed on 85 right kidneys and 57 left kidneys.\textsuperscript{5,6}

In the results of the study, in general, there was a change in sodium levels where before the PCNL action the mean sodium was 135.72 +5.97 and after the action it was found that the mean sodium was 134.17 + 4.42. It was also found that the sodium level before the procedure was 138.65 and after the procedure it was 138.65.\textsuperscript{3,4}

There was a statistically significant decrease, where the initial sodium level was 139.875 while the final result was 137.725, but although statistically this means that the decrease in sodium levels that occurs does not require action to correct sodium levels.\textsuperscript{7} This can occur because there is intervention in the kidney and irrigation, which continues to the vital organs, namely the kidneys.\textsuperscript{8,9}

There were differences in sodium levels between the pre-operative (mean=140.60, SD=3.03), intra-operative (mean=141.00, SD=1.28) and post-operative (mean=138.85, SD=3.26) with p value <0.05 with 2 factor ANOVA without replication test.\textsuperscript{3} This can occur because there is intervention in the kidneys and continuous irrigation of vital organs, namely the kidneys.\textsuperscript{8,9}

There were also differences in sodium levels between the pre-operative (mean=140.60, SD=3.03), intra-operative (mean=141.00, SD=1.28) and post-operative (mean=138.85, SD=3.26) with p value <0.05 with 2 factor ANOVA without replication test.\textsuperscript{3}

This can occur because there is intervention in the kidneys and continuous irrigation of vital organs, namely the kidneys.\textsuperscript{8,9}

The same thing was also found in the Sekar et al (2018) study where there were differences in sodium levels between the pre-operative (mean=140.60, SD=3.03), intra-operative (mean=141.00, SD=1.28) and post-operative (mean=138.85, SD=3.26) with p value <0.05 with 2 factor ANOVA without replication test.\textsuperscript{3}

In this study, it was also seen related to the relationship between electrolyte levels which were affected by the part of the kidney that was carried out by PCNL, in the PCNL that was done on the right, the sodium level found before the action was 136.55 + 6.5 mEq / L and after action is 134.55 ± 5.14 mEq / L with a p value of 0.243, it was found that the pre-action value was 3.61 + 0.71 mEq / L and after the action is 3.50 ±0.54 mEq / L with p value> 0.05, while the chloride content before treatment was 103.95 + 3.22 mEq / L and the after action score was 103.40±3.10 mEq / L with p value= 0.118. At the left PNCL location, it was found that the pre-treatment sodium levels were 135.11 + 5.6 mEq / L and after action is 133.89 + 3.88 mEq / L with p value is 0.131 and the potassium level is found to be 3.93 ± 0.79 mEq / L and after action the potassium content was 3.70 + 0.59 mEq / L with a mean value of 0.22 and a p value of 0.05 was obtained, while the chloride content before the action was 103.59 + 3.54 mEq / L whereas after the action the value was 103.56 + 3.40 mEq / L with p value is 0.131, so it can be concluded that there is no statistically significant difference between electrolyte levels and the location where PCNL was performed. So that in this study there was no significant difference between the electrolyte values before and after the PCNL action.

V. CONCLUSION

There is no meaningful difference between electrolyte levels before and after PCNL based on the duration of action.

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Electron Transfer Modelling for the Effect of Magnetic Fields on the Photosynthesis Microalgae Enzyme (Nonnochloropsis Salina)

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Abstract- A mathematical modeling is applied to illuminate and predict the mechanism of electron transfer in algae photosynthesis. A magnetic field can accelerate its reaction by decreasing the frequency of reverse reactions in the radical pair mechanism. The effect of magnetic field (MF) changes the rotational dynamic of the radical pair and in general alters the yield and lifetimes of its product. The external magnetic field applied to the system causes a radical pair reaction change. This phenomenon can be explained by a rate constant \( K_3 \) for dual-reaction coordinate movement or triplet state formulation and according to the effect of the function rate dependent on magnetic \( K_{ISC} \). To achieve a desired magnetic effect on the system, state that the of \( K_i \) and \( K_{ISC} \) rates must be equally large to observe the effect of the magnetic field on the reaction rate. In systems with forward reaction rate at \( K_3 > K_{ISC} \), the modeling result indicates that the maximum rate of effectiveness, \( f(K_{ISC}) \) is likely to occur at \( \approx 7.85 \) militesla with \( (K_{ISC}) \) value at \( 2.63 \times 10^{-10} \) second. As simulated into the system, the MF influences reach at peak values of between \( 7.25 \text{mT} \ (6.24 \times 10^{-9} \text{second}, \text{reaction rate}) \) to \( 8.25 \text{mT} \ (3.94 \times 10^{-10} \text{second}, \text{reaction rate}) \). The significant result of the MF influences towards the microalgae growth production is indicated the range of \( 1 \times 10^{-10} \) to \( 7.75 \) militesla is observed to have influence on the rate of \( f(K_{ISC}) \).

Index Terms- mathematical modeling, influence, accelerate, convert, energy reaction, effect, transfer, absorb.

I. INTRODUCTION

In algae photosynthesis, lights are transferred into chemical energy via photo induced electron transfer reaction. The whole process consists two consecutive: Light and dark phase. The light reactions include light absorption, transfer of excitons, and electron and proton translocation resulting in the production of NADPH2, ATP, and oxygen. In the light phase, a photochemical process occurs, transforming the photon energy of solar radiation into chemical energy. At first, the energy of the radiation is converted into the energy of the excited electrons, which is converted by oxidoreductase to macroergic compounds - ATP (adenosine triphosphate, source of chemical energy) and NADPH (nicotinamide adenine dinucleotide phosphate, reducing agent). The light reaction is due to the photosynthetic apparatus experiences sequences reaction as refer to photoreceptors that contain radiation-absorbing pigments, photosynthetic reaction center, where light energy is converted into electrical energy (= electron excitation by absorbed radiation) and string oxidoreductase, where excited electrons are converted to chemical energy (formation of ATP and NADPH) [1].

The reaction centre itself is composed of the two intrinsic polypeptides D1 (psbA) and D2 (psbD). D1 and D2 form a heterodimer and bind a variety of photochemical components such as chlorophyll P680, pheophytin, tyrosine YZ, and plastoquinone...
The photosynthesis process starts with the excitation of the chlorophyll-a molecule pair P680. The excited of P680 molecule pair transfers an electron to another photochemical Pheophytin. This electron is subsequently captured by the pheophytin as the primary electron acceptor. Four chlorophyll molecules and two pheophytin molecules are arranged into two branches associated with proteins D1 and D2 and located in the central part of the enzyme. The quinone acceptor complex of PS2 consists of two plastoquinone molecules with significantly different properties. The primary (QA) and secondary (QB) quinone acceptors function as one- and two-electron carriers, respectively as series of electron then is move to the plastoquinone QA, which is reduced to Q- A. The electron moves via plastoquinone is to be believe one of the radical pair mechanism in algae photosynthesis. The subsequent reoxidation occurs via another plastoquinone, QB, followed by taking up two protons as plastohydroquinol PQH2, transports the electrons to the cytochrome b6/f complex. A new plastoquinone QB from the so-called plastoquinone pool.

Figure 1: Z-scheme of the photosynthetic electron transport chain with a primary Radical pair mechanism that effected with the magnetic influences state as RP1, RP2 and RP3.

Figure 1 shows that the axis on the left side of the diagram indicates the energy with respect to the redox potential $E_m$ at pH 7. After photon absorption, the reaction centers of photosystem II (P680) and photosystem I (P700) each change to the excited state P680* and P700*, respectively. P680* gives an electron to the pheo- oxidizing side of the PSII, the oxidized P680 is reduced by tyrosine Z (Tyr, YZ). YZ phytin (Pheo), which is then forwarded to the plastoquinones QA and QB. In turn, its electrons are obtained from the manganese complex, which in turn removes them from the water [Whitmarsh and Govindjee, 2001].

The photosynthesis process starts with the excitation of the chlorophyll-a molecule pair P680. In most cases, the excitation energy is provided by an exciton transfer from the adjacent antenna complexes. The excited reaction center itself is composed of the two intrinsic polypeptides D1 (psbA) and D2 (psbD). D1 and D2 form a heterodimer and bind a variety of photochemical components such as chlorophyll P680, pheophytin, tyrosine YZ, and plastoquinones QA and QB [Richter, 1996]. P680* transfers an electron to pheophytin a within 3 ps. From there the electron is passed on to the plastoquinones QA and QB after 300-500 ps, resulting in QA reduced becomes. The subsequent reoxidation occurs via another plastoquinone, QB, which, in contrast to QA, can pick up a second
electron after renewed excitation before it then carries the electrons to the cytochrome b6 / f complex after taking up two protons as plastohydroquinol PQH2. A new plasma quinone QB from the so-called plastoquinone pool moves to the vacated area [Kern and Renger, 2007]

II. Electron Transfer Model

Electron Transfer Model (ETM) is reflected to photosystem within the photosynthesis system unit (PSU) that is defined as the reaction scheme from the effect of magnetic field (MF) as represented in Figure 2.

![Figure 2. Photosystem unit (PSU) with magnetic effect radical pair mechanism.](image)

The electron affinity of the acceptor molecules is increased upon the excitation with the effect of external MF. This is due to its collision with the donor molecule, Pheo. P* reduces a pheophytin a molecule Pheo within a few nanoseconds to form the radical pair state, \( P^+ \cdot Pheo^- \). For these processes, there are however two (2) possibilities in which either the singlet ground state \( (P^+ \cdot Pheo^-) \) or the triplet excited state of the acceptor \( (3P680^+ \cdot Pheo^-) \) are produced.

Figure 2 demonstrates the schematic diagram of the primary excitation, charge separation and recombination processes in the reaction center through P680 and Pheopytin which can be written as follows:

- \( P680(P*) \rightarrow \text{excitation process} \)
- \( P680(P*) \rightarrow \text{charge separation} \)
- \( (P^+ \cdot Pheo^-) \rightarrow \text{recombination process} \)

III. Coherent and Stochastic Motion

The state obtained depends on the relative alignment of the two unpaired electron spins of the electron back-transfer: singlet alignment leads to the singlet ground state and triplet alignment to the triplet state.” The recombination (i.e. electron back-transfer) takes place over two (2) different time periods. A slow homogeneous recombination occurs after separation of the initially formed radical ion pairs” [1]. “Because of the small concentration of the initial pairs, the radicals must be diffused for about 10 ns” [2] “before they encounter other free radical ions with subsequent electron transfer. In this random encounter of radicals, the electron back-transfer produces result in singlet and triplet products. Since the relative orientation of the electron spins of 2A⁺ and 2D⁺ is
random, one has a 25% probability for singlet and a 75% probability for triplet alignments. The application of MF affects the spin dynamics of a radical pair and changes its product yields and lifetimes. MF can speed up a reaction by decreasing the frequency of reverse reactions” [3].

Coherent and stochastic motion in electron spin leads to interaction such as spin-orbit, exchange and hyperfine or Zeeman interaction in radical. The introducing of external magnetic field to radical at steady state gives a significant effect to the electron spin motion and triplet-singlet recombination product. “An analysis of the hyperfine coupling-induced recombination yields and their MF modulation furnishes valuable information about the existence of a short-lived radical pair and its microscopic diffusion in a solvent-mediated force field and about the reaction propensities to form singlet and triplet products” [1][4].

IV. Model Development Michaelis-Menten Kinetics

The MF introduced to the system influences the radical pair effect at ion exchange generation through $k_2$, a modified Michaelis-Menten kinetics with MF-dependent reaction rate are derived as in Eq. (1).

$$v_{mag}^m = \frac{K_4}{1 + \left( \frac{K_4}{K_2} \right) \left[ E_{TOTAL} \right]}$$

Where, $v_{mag}^m$ is the maximum substrate concentration, $E_{TOTAL}$ is the total enzyme concentration. Furthermore, $K_{mag}^m$ is defined as constant rate of reaction in which the influences of MF is given in Eq. (2).

$$K_{mag}^m = \frac{K_4}{1 + \left( \frac{K_4}{K_2} \right) \left[ 1 + K_2 + \left( \frac{K_2}{f(K_{ISC})} \right) / K_3 \right]}$$

Where, $K_{ISC}$ represents the influence of MF for the modified effective rate constant of radical pair recombination, $K_2$. Reaction rate at $K_{ISC}$ is treated as a monotonic function $f(K_{ISC})$: $K_2 \rightarrow K_2 * ISC$, which leads to $K_2 / f(K_{ISC})$ as a new form of reaction rate at radical pair recombination with the influences of MF as shown in Eq. (3).

$$f(K_{ISC}) = \frac{2K_{ISC} + K_3}{K_{ISC} + K_3}$$

The probability of radical pairs recombination is given by $P_{ISC}$. Thus, the influences of magnetic in radical pairs to determine the probability of singlet and triplet formation as in Eq. (4).

$$V^P = K_2 \left[ \left| 1 - K_{ISC} / f(K_{ISC}) \right| \right]$$

The rate of radical pair formation is represented as $K_2 \left| 1 - AD \right|$. Further assumption is made as referring to the model radical pair recombination [11] with assumption made by [12], [13] which is assumed that the radicals are separated after a certain period of time and subsequent re-encounters are neglected. The probability of radical pair recombination under steady state is given in Eq. (5).

$$p_{ISC} = \frac{K_2 / \left( K_{ISC} + K_3 \right)}{f(K_{ISC}) + K_3}$$

Numerical values of $K_2$ and $K_{ISC}$ are estimated from numerical and literature experimental studies. The recombination of radical pair is typically occurring at the range of $10^9 \text{s}^{-1}$. The initial spin correlation is removed at a lower range with the rates of $10^6 - 10^8 \text{s}^{-1}$ due to the electron spin relaxation processes. Intersystem crossing is induced by the hyperfine interaction mechanism that
occurs at the comparable rates in which the typical values of the hyperfine coupling constant are between 1mT to 10mT which is equivalent in between 0.2x10⁹ to 2.0 x 10⁹ rad/s. Finally, the Δg mechanism can also lead to intersystem crossing rates exceeding 10⁹-10¹⁰ s⁻¹. C. [10] for example utilizing the Δg value as 0.25x10⁻⁶ for the magnetic flux densities are in the range of 10mT to 100mT [11] and [14] have extended the probability equation for the rate dependent of magnetic effect at the rate of \( K_{ISC} \) with the interaction and modification of hyperfine interaction constant (rad/s) with external MF. In their research publication hyperfine interaction, it is defined as Intra-radical coupling between the magnetic moment of an atomic nucleus and the magnetic moment of an unpaired electron, for zero MF, the rate of \( K_{ISC} \) is represented Eq. (6).

\[
K_{ISC}(0)=3\left(\frac{K_{-2}+2K_3}{(K_{-2}/2+K_3)^2+(2J+a/2)^2}\right)^2 \left(\frac{a}{4}\right)
\]

(6)

The equation is multiplied by the value of 3 due to an assumption made at zero value of MF. There are three (3) possibilities for singlet-triplet interconversion (\( T_0, T_+1 \) and \( T_0 +1 \)) in the radical pair mechanism as the increasing of external MF in which the applied MF is greater than the hyperfine interaction, \( B >> A_{Hyperfine} \). Only one possibility channel remains \( T_0 \), in which this effect is due to the Zeeman interaction at \( T_+1 \) and \( T_0 +1 \) states that are energetically separated from the singlet-triplet interconversion states.

If MF is represented by \( B \) that is assumed \( B >> A_{Hyperfine} \), then the rate can be defined as in Eq. (7).

\[
K_{ISC}(B)=\left(\frac{K_{-2}+2K_3}{(K_{-2}/2+K_3)^2+(2J)^2}\right)^2 \left(\frac{(\Delta\omega)^2+(a/4)^2+\gamma[(\Delta\omega)^2-(a/4)^2]^2}{1+\gamma[(\Delta\omega)^2+(a/4)^2]^2}\right)
\]

(7)

in which,

\[
\gamma = \frac{1}{K_3(K_{-2}+K_3)}\left(\frac{K_{-2}+2K_3}{(K_{-2}/2+K_3)^2+(2J)^2}\right)
\]

(8)

\[
\Delta\omega = \Delta g \mu / (2h)
\]

(9)

where,\n\[
a = \text{Hyperfine interaction constant (rad/s)}
\]
\[
J = \text{Exchange interaction between the unpaired electron spin of the radicals’ pair}
\]
\[
\Delta g = \text{The difference between g-factors of two radical}
\]
\[
H = \text{Reduced plank constant}
\]
\[
B = \text{MF}
\]

If, \( J \approx 0 \) and \( MF \approx 0 \) or MF is very weak, then \( B << A \) and \( \Delta\omega \) becomes negligible.

Martin Volk and Matthias Gilbert (1993) report that the determination rate in photosynthesis radical pair via high resolution MF-dependent measurements [6]. They investigate the comparison on the recombination rates of P680’ Pheo’ for photosystem II in photosynthesis within the temperature ranges from 90K to 300K. The results allow conclusion on the combination and recombination of radical pair in Photosystem II (PS II), Reaction center (RC), chlorophyll (Ch-1), Pheophytin (Pheo), P680, primary donor in PS II, primary donor in algae photosynthesis and MF dependence of the reaction yields for S-T-mixing are singlet-triplet-mixing.

The external MF influences the photosystem which gives a significant effect for the triplet recombination channel, thus increases the radical pair lifetime[7]. This shows that both PS II and bacterial RCs of the singlet recombination rate is smaller than the triplet recombination rate. The singlet recombination rate in principle can be determined by the MF dependence at values of 0.002 ns at 90K and 0.01 ns at 290K are obtained with smaller than the values that is found in bacterial reaction centre[8].

The previous simulations result is gathered by employing the stochastic Liouville equation, MF modulation of the triplet yield and sensitivity of \( K_{Singlet} \) indicate that rate of singlet formulation has values approximately at 0.0004 ns⁻¹ at 90K and 0.0015 ns⁻¹.
at 290K. Furthermore, Trissl and Iavergne (1994) summarize the constant value of exciton radical pair model in their publication is continued by Bernd.M.A Kroons (2006) as shown in Table 2.1.

**Table 2.1**: Literature constant value of exciton radical pair model.

<table>
<thead>
<tr>
<th>Constant</th>
<th>Value</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charge of recombination in PSII units with open centers $\left( K_{Re} \right)$</td>
<td>0.3</td>
<td>ns$^{-1}$</td>
<td>The value of singlet and triplet recombination $\left( K_{-2} + K_3 \right)$, [6]</td>
</tr>
<tr>
<td>Reduction rate of quinone acceptor $Q_A$ (radical pair reduction)</td>
<td>2.3-4</td>
<td>ns$^{-1}$</td>
<td>Value of radical pair decay in PSU II open centre $\left( K_4 \right)$, [6]</td>
</tr>
<tr>
<td>$K_3$ represent bi-reaction coordinate motion / formulation of triplet state</td>
<td>30-60</td>
<td>ns$^{-1}$</td>
<td>Martin Volk and Matthias Gilbert (1993)[1]</td>
</tr>
<tr>
<td>$K_{-2}$ formulation of singlet state</td>
<td>0.01 at 290K</td>
<td>ns$^{-1}$</td>
<td>Martin Volk and Matthias Gilbert (1993)[1]</td>
</tr>
<tr>
<td>Trapping constant for photosystem $\left( K_1 \right)$ unit, depend on the chl a and chl b molecules</td>
<td>$\frac{540}{chl_a + chl_b}$</td>
<td>ns$^{-1}$</td>
<td>Radical pair model Tridsl and Lavergne 1994[9][6]</td>
</tr>
<tr>
<td>Rate $K_2$ Combination rate as of radical pair combination</td>
<td>4-6</td>
<td>ns$^{-1}$</td>
<td>Chlorophyll triplet radical pair Alexander Angerhofer 1995[10]</td>
</tr>
</tbody>
</table>

V. Result and Discussion
The electron transfer mechanism continues to rise up until a certain maximal value represents the condition in which all the active sites in enzyme activity are filled with the appropriate substrate at a constant concentration of an enzyme in the PSU unit. Applying MF into the enzymatic system influences the formation of enzyme-substrate complexes as the rate of turn-over time is reduced and becomes the main factor in radical-pair mechanism affection as shown in Figure 3.

Applying MF into the enzymatic system influences the formation of enzyme-substrate complexes as the rate of turn-over time is reduced and becomes the main factor in radical-pair mechanism affection as shown in Figure 3.

**Figure 3.** Simulation of MF effect on the Rate $K_{ISC}$ and on the growth probability of microalgae in a function of magnetic flux density, B (0-20 mT), (Eq. 7).

Microalgae productivity is the dependent rate in the determination of magnetic function. In order to achieve a desirable magnetic effect to the system, the rate excitation and respiration must be of similar magnitude to observe the effectiveness of MF on the reaction rate [10]. However, the effectiveness of MF against the singlet and triplet states (at photosynthesis) is always neglect able due to the short period of turnover time.

On the other hand, for the system with reaction with rate of short period of turnover time shows that the maximum rate of is likely to occur at approximately 7.85 mT at the range of 2.63x10^{-10} second. The reaction rate per second show the influences of applied MF at range 5mT to 10mT, the reaction rate indicated a decreasing of reaction time from range of 1x10^{-6} second to 1x10^{-10} second with the increasing applied MF. However, the applied MF more than 9mT shows the increasing of reaction rate time as indicated the MF is no more having an influences of microalgae productivity. These simulation results give an insight that the applied MF decreasing the reaction time as the electron transfer mechanism likely to be accelerate.

**Figure 4.** MF effect on the $K_{ISC}$ , and on the radical pair mechanism in the reaction rate (in second) as a function of magnetic flux density, B (5-10 milli-Tesla),(Eq 7).
Figure 5. MF effect on the $K_{ISC}$, and on the radical pair mechanism in the reaction rate (in second) as a function of magnetic flux density, B (7.25-8.25 milli-Tesla), (Eq. 7).

The reaction rate, $K_{ISC}$ is treated as a monotonic function $f(K_{ISC}): K_{-2} \rightarrow K_{-2}/ISC$, which leads to the $K_{-2}/f(K_{ISC})$. The main reason for the function to be treated as monotonic is that as the influences of MF to the entire system, the magnetic effect can be assumed by either increasing or decreasing the rate constant of turnover time of radical pair formulation. From the simulation case, this function is assumed to have an increasing interval with the range of $1 < f(K_{ISC}) < 2$. The simulation results are plotted in Figure 6 and Figure 7.

Figure 6. Monotonic function, (Eq.3), as the influences of MF to the entire system

Figure 7. MF effect on the rate $K_{m}^{max}$, represented as the rate of is defined as concentration of substrate at which the reaction speed is half of the $V_{max}$
Enzyme turnover number in the previous section is defined as the amount of substrate molecule that is converted into a product in an enzyme-catalyzed reaction. The MF influences the turnover number in algae photosynthesis enzyme activity which is depending on the rate-limiting step as it is represented in the previous section with the limited rate of $K_2$ (combination rate of radical pair) and $K_4$ (reduction rate of quinone acceptor $Q_A$). If the reaction rate is at $K_2 << K_4$, which is based on the radical pair theory [12], [13] and [20], the magnetic effect alters the maximum enzyme reaction rate as represented by $V_{max}^F$ as shown in Eq. (10).

$$V_{max}^F = \frac{K_2}{1 + (K_2 + K_{-2}/f(K_{ISC})/K_3)}$$

(10)

The turnover number of the enzyme can be calculated depending on whether the rate-limiting step in the enzyme cycle occurs before or after radical pair generation. If $K_2 << K_4$, then the result can be simulated as plotted in Figure 8.

![Figure 8. Simulation Result on enzyme turnover number in radical pair mechanism.](image)

**VI. Conclusion**

The mathematical modelling for the MF effectiveness of the electron transfer energy towards the algae photosynthesis is successfully developed and the simulation results are discussed. The rate of production of microalgae is determined by the effectiveness of the magnetic energy supplied. The MF influences is exerted on the recombination probability as the theorem derived from origin transition state theory focusing on radical pair mechanism that is generated within the photosystem unit PSU.

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Impact of Polya’s Problem-Solving Model On Students’ Mathematics Performance in Junior Secondary Schools in Zamfara State, Nigeria

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Abstract- This study sought to find out the impact of Polya’s Problem Solving Model on students’ mathematics performance in junior secondary schools in Zamfara State Nigeria. Two research questions were drawn and two hypotheses were formulated and tested at 0.05 level of significant. Quasi-experimental design was used for the study. The population of the study is (229) junior secondary schools with an estimated population of (97,334) students. A sample of (360) students was drawn from six junior secondary schools. A multi-stage sampling technique was used to select the schools and intact classes were selected using connivance sampling techniques. The researcher used Polya’s Problem Solving Instructional Model (PPSIM) as treatment for experimental groups while Discussion Method was used for control group. The instrument used for data collection was Mathematics Performance Test (MPT) was subjected to face and content validity by some experts. The reliability of the instrument was determined using split half was used to determine the reliability using Pearson Product Moment Co-efficient (PPMC) and corrected with Spearman’s Brown, Coefficient which was found to be 0.82. The data collected were analyzed using mean, standard deviation and t-test statistics. The findings of the study revealed that there was significant difference between performance of students in experimental group taught word problem using Polya’s Problem Solving Instructional Model and control group taught word problem using Discussion Method. It was therefore recommended among others that since Polya’s Problem Solving instructional model improves students’ performance in mathematics word problem than the discussion method, there is need to provide opportunities for students to engage in problem solving on a regular basis. This facilitates better understanding of various method of teaching problem solving in our school.

I. INTRODUCTION

Polya’s problem solving model is explicit in characterizing the heuristics of effective problem solving. Essentially, the model attempts to understand how people think and the strategies they use when solving problems. Polya (1973) contends that to solve any problem, the characteristics and properties of the problem should be analyzed. Once the problem is understood then a plan is devised and strategies are implemented and finally, opportunities to reflect upon the solution are required. George Polya’s book marked a line of demarcation between two eras, problem solving before and after Polya’s. In order to realize the objectives of teaching mathematics at the secondary school level, the readiness of the learner, teacher proficiency and effective use of appropriate teaching strategies are important indexes (Agwagah, 2004). A lot of innovative mathematics teaching strategies have been developed by Ghosh, (2012) in order to intimate students with the applicability of the mathematics concepts, reducing mathematics phobia and anxiety among students, easing their proficiency in mathematics problem solving skills and mastery of the concepts rather than rote and memorization. These strategies include the use of Polya’s problem solving model (Ghosh, 2012).

In today’s society, people are constantly faced with problems or dilemmas they must sort through to arrive at a solution. Many times the problems are complex with many different aspects, so there are no step by step algorithms for people to apply. According to Schoenfeld (2002), Students are not going to become quantitatively literate and logical thinkers, and therefore be successful in today’s society, without some changes occurring in the mathematics classroom.

These students typically have been taught in traditional mathematics classrooms, learning basic skills and algorithms to solve problems, and have not been provided with opportunities to think on their own. This method is still the norm in our nation’s schools and has continued to dominate the mathematics classroom. In traditional teaching, students acquire mathematical skills through imitating demonstrations by the teacher and the textbooks. Also, in traditional mathematics instruction, the teacher on daily basis shows the students several examples of how to solve a certain type of problem and have them practise this method in the class and as homework. This is what Ogunkunle (2007) refers to as talk and chalk method.

The use of talk and chalk method has become burdensome and worrisome because it does not establish the link between mathematics concepts learnt in the classroom and their applicability to real life situations hence denying students of meaningful learning (Ogunkunle & George, 2015; Sidhu, 2006). Jonah-Eteli (2010) observed that generally teachers discuss worked examples, sometimes leading to formulae and then ask the students to work exercises based on the examples or using the formulae. This method of teaching leads learners to memorize...
mathematical formulae methods and examples as presented by the teacher.

The performance of students in mathematics has been of great concern to the society (Awokoya in Malik, Ngban & Ibu 2009). Fafunwa in Malik et.al (2009) both agreed in different researches that we live in a world where science and technology have become integral part of the world culture, therefore, for any nation to be relevant, it must not overlook the importance of mathematics in her educational system. Accordingly, the observed poor performance in mathematics has been a matter of serious concern to all well-meaning educators. Students’ poor performance in mathematics over the years has been attributed to the fact that the subject is difficult. In the same view, students’ performance in mathematics tests has been observed to vary from student to student, from school to school and from state to state in Nigeria. This prompted the researcher in using Polya’s problem solving model to teach certain concepts in mathematics to see whether it will improve performance in mathematics more specifically in Zamfara state.

II. STATEMENT OF THE PROBLEM

Mathematics has acquired the status of a compulsory subject up to a certain academic level in almost every nation of the world. The need of students for reckoning in everyday life has caused a change on their performance in mathematics. Yet many students complain that it is difficult to learn, understand and pass mathematics examinations. One begins to ask what might be the reason for such poor performance of students in mathematics. Some of the problems are as follows: Students’ problem, teachers’ problem, administrative problem, environmental problem, parental and schools’ problems.

Lack of interest, motivation and mathematics belief as well as negative attitude towards mathematics on students’ side may hamper their academic progress. For example, students may not be promoted into the next class or even get admission into university if they fail mathematics. Some of the schools within Zamfara Metropolis revealed that most teachers are in a hurry to solve a problem and make it a teacher-centered without allowing students to participate, teachers do not use variety of methodology and instructional materials in teaching, mathematics which may cause students to become frustrated and loose interest in the subject and the entire academics. Also, schools’ inability to provide adequate time for mathematics lessons, adequate facilities, adequate instructional materials and enough space in classrooms have resulted to students’ poor performance in mathematics.

Whatever factor(s) may be responsible for such complain how to improve students’ performance in mathematics has always been one of the major problems confronting the government, mathematics educators, teachers of mathematics and parents alike. Previous studies have shown that methods of teaching mathematics through listening, looking and learning have not been successful. If anything, the method has only resulted in making students dislike mathematics. The result of this traditional approach is poor literacy in mathematics, poor performance in internal examinations and students’ general dislike or phobia for mathematics. The results of mathematics examination of students in Junior Schools (JLSC) from 2011 to 2016 have shown that more than 40% of students in the year 2014 and 2015 failed mathematics examination in Zamfara state the reasons is because of unqualified teachers, lack of support from parent and government. Therefore, it is in attempt to find alternative way of teaching mathematical concepts to students of Junior Secondary Schools in Zamfara State that the researcher sought to impact the use of Polya’s problem solving model on students’ performance in mathematics as opposed to the use of discussion method.

III. OBJECTIVES OF THE STUDY

The objective of this research to find out:

1. Whether the performance of students will improve if taught word problem using Polya’s problem solving model instead of using discussion method.
2. If there exist a gender difference among students’ performance in word problem when Polya’s problem solving model are used;

Research Questions

The study answered the following questions:

1. What is the difference between the performance of students taught word problem using Polya’s problem solving model and discussion method?
2. Is there any difference in the performance of male and female students taught word problem using Polya’s problem solving model?

Null Hypotheses

The following hypotheses stated in null form were tested: at 0.05 level of significance.

H₀₁: There is no significant difference between performance of students taught word problem using Polya’s problem solving model and discussion method.

H₀₂: There is no significant difference between performance of male and female students taught word problem using Polya’s problem solving model.

IV. METHODOLOGY

This study aims at investigating the use of Polya’s Problem Solving Model on students’ performance in word problems. The effectiveness of these models was compared with that of the Discussion Method. The study employs quasi-experimental design of the type pretest, posttest equivalent, non–randomized and control group only. The target population of this study is junior secondary school students of Zamfara State. There were two hundred and twenty nine (229) Junior Secondary Schools in Zamfara State, with an estimated population of ninety seven thousand three hundred and thirty four (97,334) students. The sample for the study was drawn from junior secondary school two (JSS II), the use of multi-stage sampling techniques i.e. hat-draw method was used to select the schools and intact classes were selected using convenience sampling technique. The instrument that was used in carrying out this study was; Mathematics Performance Test (MPT). The MPT consisted of five (5) theory questions for the students to answer all. MPT was subjected to face...
and content validation. By experts in the Department of Science and Vocational Education, Usmanu Danfodiyo University Sokoto. A pilot study was carried out using one (1) intact class Sixty (60) students of Junior Secondary School II at Ibrahim Gusau Government Days Secondary School, Zamfara State. The selected school is part of the population but not part of the sample for this study. A split half was used to determine the reliability using Pearson Product Moment Co-efficient (PPMC) and corrected with Spearman’s Brown, Coefficient which was found to be 0.82. After the marking sessions, the raw scores were subjected to analysis. The descriptive statistics mean and standard deviation to answer the research questions and t-test to test the null hypotheses formulated to further confirm the veracity of the difference in mean scores using SPSS Package (20.0) at 0.05 level of significance.

Table 1: t-test Analysis of Performance Mean Scores of Experimental and Control Groups

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>Df</th>
<th>t-value</th>
<th>p-value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group</td>
<td>157</td>
<td>33.86</td>
<td>17.09</td>
<td>358</td>
<td>6.18</td>
<td>0.000</td>
<td>Rejected</td>
</tr>
<tr>
<td>Control Group</td>
<td>203</td>
<td>23.72</td>
<td>13.89</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( \alpha = 0.05 \)

Source: Field work, 2018

To test this hypothesis, the mean scores of students in experimental and control groups were subjected to t-test statistic and summary of analysis are shown on Table 1. The result shows that the experimental group has higher mean scores of 33.86 as compared to that of control group with mean scores of 23.72. The calculated t-value was 6.18 while the p-value is 0.00 which is less than \( \alpha = 0.05 \) level of significance at 358 degree of freedom. Hence, the null hypothesis was rejected.

Research Question two: Is there any difference in the performance of male and female students’ taught word problem using Polya’s problem solving model?

Null hypothesis two

\( H_02: \) There is no significant difference between mean score of male and female students’ taught word problem using Polya’s problem solving model.

Table 2: t-test Analysis of Post Test Means Scores of Male and Female Students Taught Word Problem Using Polya Problem Solving Model.

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>Df</th>
<th>t-value</th>
<th>p-value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Experimental</td>
<td>83</td>
<td>20.36</td>
<td>14.39</td>
<td>155</td>
<td>-4.91</td>
<td>0.000</td>
<td>Rejected</td>
</tr>
<tr>
<td>Female Experimental</td>
<td>74</td>
<td>33.23</td>
<td>18.39</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\( \alpha = 0.05 \)

Source: Field work, 2018

To test this hypothesis, the mean scores of male and female students in experimental groups were subjected to t-test statistic and summary of analysis are shown on Table 2. The results in Table 7 shows that at df 155, t-value is -4.91 and p-value observed is 0.000 and is less than 0.05 level of significance. Consequently the null hypothesis is rejected.

VI. DISCUSSIONS

The main objective of this research was to find out whether the use of Polya’s problem solving model has effect on the performance of junior secondary schools students in Zamfara State Nigeria in word problem. To achieve this aim student in experimental group were taught Word Problem using Polya’s Problem Solving Instructional Model while students in control group were taught Word Problem without Polya’s Problem Solving Instructional Model. Therefore, the observed differences in the result were due to treatment. The result of the analysis of data on the research question and null hypotheses are hereby discussed.

The results of analysis presented in Table 1 show that Polya Problem Solving Model was found to improve the performance of experimental group in word problem compared to that of control group taught with discussion method. The students taught word problem with Polya’s problem Solving Model had a higher mean score than the students taught using Discussion Method. These findings agree with the earlier findings of Galadima (2002), who conducted his study on effect of heuristic...
problem solving instruction on secondary school students’ performance in algebraic word problem and found out that Polya model has the greatest effect on students’ performance. This result is in agreement with the findings of Suleiman (2010) whose works, found a significant difference between the performance of the experimental and control group where the experimental group taught with Polya’s Problem Solving Model performed better than their counterpart taught with Conventional Method.

The result of the analysis presented on Table 2 between male and female student showed that Polya Problem Solving Model was found to improve the performance of female students more than male students in the experimental group, the finding from this study indicated that gender has effect on learning word problem with Polya’s Problem Solving Model. The finding agrees with the earlier findings of sulaiman (2010) which was found that gender has effect on students’ performance. Also Fasasi (2015), conducted a study on the effect of Heuristic Teaching Approach on academic achievement of Senior Secondary School Mathematics students in Adamawa State, Nigeria the results revealed that the Heuristic teaching approach benefited boys in the experimental groups as they achieved significantly better than girls in the experimental group and the control group in their mathematics achievement test. It also revealed that the difference in the achievements of male and female is significant. The finding in lines with that of Galadima and Okogbenin (2012) did a research on the effect of mathematical games on the academic performance and attitudes of senior secondary school students toward mathematics in Sokoto state. The result shows that there was no significant difference in the performance of male and female students exposed to mathematical game method. The result of this finding concur with that of Fajemidagba (2012), who revealed that both the polya’s and Branford model has effect on the gender of the students.

VII. CONCLUSIONS

From the analysis and interpretation of the data collected, the following conclusions were drawn:
1. The use of Polya’s Problem Solving Instructional Model as a means of instruction tools in word problem improve the students’ performance as observed in the means scores of the experimental group taught word problem and those with discussion method.
2. The use of Polya’s Problem Solving Instructional Model was found to be gender friendly because female student perform better than male students taught word problem using PPSIM.

VIII. RECOMMENDATIONS

The following recommendations are made in the light of the findings of this study.
1. Polya Problem Solving instructional model improved students’ performance in mathematics word problem than the discussion method. Therefore there is a greater need to provide opportunities for students to engage in problem solving on a regular basis. This facilitates better understanding of various method of teaching problem solving in our school.
2. It was observed that, Polya Problem Solving Model improve Male and Female Students performance in mathematics word problem than the traditional method. Secondary school mathematics teacher should be trained through intensive workshop, seminars, and in-service training on the use of Polya Problem Solving model for teaching and learning of mathematics. This will expose the teachers to the various problems solving model and use them in the classroom for better understanding and learning of mathematics by the students.

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AUTHORS

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Development of Mind Mapping Teaching Materials in Introductory Education Courses

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Abstract- This research was conducted with the aim of compiling introductory education teaching materials by applying mind mapping. This research was conducted in an introductory course of education for new students in 1st semester. This research used Research and Development (R&D) method. This research was carried out in five stages. The validation test was carried out by four experts. Total mean score was 86 and included in excellent criteria, while the teaching materials were included in the feasible or usable category.

Index Terms- Teaching Materials, Introduction to Education, Mind Mapping

I. INTRODUCTION

Kampus merdeka: Merdeka Belajar, is the newest slogan for education of higher education level in Indonesia. It is in accordance with the President's direction, namely "Achieving the 2045 vision through economic transformation supported by downstream industry by utilizing human resources, infrastructure, simplifying regulations, and reforming the bureaucracy". This is kind of government's intention to improve and enhance the quality of Indonesian education. Education is regulated in Law Number 20 of 2003 as well as Law Number 12 of 2012 concerning Higher Education. Apart from the law, the legal basis for Indonesian education is also contained in the Presidential Decree, namely Presidential Decree No. 8 of 2012 on Indonesian National Qualifications Framework (INQF), and several ministerial regulations. In Law No. 20 of 2003, in article 1 paragraph 1, it is written that:

"Education is a conscious and planned effort to create a conducive learning atmosphere so that students are actively develop their potential to have religious spiritual strength, intelligence, noble morals, self-control and the abilities or soft skills they need to live independently, in society and for nation and state".

One of the improvement in the quality of education implemented by the government is the formulation of the INQF or the Indonesian National Qualifications Framework for education in higher education level. In Indonesia, there have been several curriculum changes for higher education, including the National Curriculum which was implemented in 1994 through the Ministerial Decree No. 056/U/1994. The main point in this curriculum was the arrangement of National Education with the existence of general courses, basic skills courses, and expertise courses. The next curriculum changing was carried out in 2000, namely KBK or Competency-Based Curriculum, with the legal basis of the Ministerial Decree No. 232/U/2000 and No. 045/U/2002. This curriculum was oriented towards global competencies, with the preparation of skills development courses, skills and scientific courses, work skills courses, work attitude courses, and social life courses. Next, curriculum changing were the Higher Education Curriculum which has been implemented since 2012 or known as KKNI and SNDIKTI. Where in this curriculum, the emphasis was on the competence of graduates based on learning outcomes. This curriculum changing has a legal basis for Law no. 12 of 2012, Presidential Decree No. 08 in 2012, Indonesian Ministry of Education and Culture Decree No. 73 in 2014 and Indonesian Ministry of Education and Culture Decree No. 49 in 2014. And the last curriculum changing or the one currently being discussed and trending is the kampus merdeka: merdeka belajar. The legal basis for this curriculum is Indonesian Ministry of Education and Culture Decree No. 03 in 2020 concerning National Higher Education Standards. Those curriculums changing are inseparable from the aspirations and hopes for the improvement of education in Indonesia, because Indonesian education is still very intelligence-oriented by the values or numbers on the students’ transcript, where Indonesian education should begin to be oriented towards creativity, understanding and skills.

Introduction to education is one of the courses presented to new students in the first semester of Economic Education Study Program. This course has an INS code in 3 credits. For new students, courses in the first semester are a transitional phase from high school students' habits to higher education students' habits that should be independent, mature and more heterogeneous. In this transitional period, they are required to adapt or adjust to a new life style that will be very different. Adjustment that occurs during adolescence is a transitional period between childhood and adulthood and includes biological, cognitive, social and emotional periods, in the age range between 13-17 years is very difficult to do (Hurlock in Listyasari, 2013). Moreover, when the world is being hit by the Covid-19 pandemic, it requires them to carry out online courses they have never done before.

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** www.ijsrp.org
When a new student starts their college, they will automatically be exposed to various kinds of changes and they are required to be able to adapt to their environment well (Spencer & Jeffrey in Listyasari, 2013). In addition, when new students start the college, they will be faced with different academic challenges from the previous period (Goodwin, 2008). New students are the group that is the easiest and most susceptible to stress (D'Zurilla & Sheedy in Fuad & Zarfiel, 2013). According to Tinto (in Nurfitriani, 2016) the first year of college is a very critical transition period, because this period is a period to build a foundation to be successful. If a person can adapt other people individually and in groups, and he/she can show good attitudes and behaviour, it can be interpreted that he/she has succeeded in adjusting to the new environment (Santrock in Listyasari, 2013).

In the learning process at Economic Education Study Program of IKIP Budi Utomo in first semester, the introductory education course is the first course taught to students, as a basis for the next educational courses. Thus, it is imperative for students to be able to master and understand in detail and well the materials in this course. On the Ministry of Education and Culture's website, namely https://spada.kemdikbud.go.id/course/pengantar-ilmu-pendidikan, it is explained that introductory education is a compulsory subject that students must take in order to equip students as prospective educators who have thoughts and abilities managing education with pedagogic abilities, social and professional personalities. The achievements in this course are:

![Diagram showing the objectives of the introductory education course](image)

**Figure 1. Introductory of Education’s Lesson Objectives**

The material discussed in this course includes the nature and development of humans, the meaning of education, elements in education, educational foundations and principles, schools of education, and problems that occur in the world of education. The teaching materials are arranged to make it easier for students to understand the material for this introductory education course, there are several CHAPTERS that are discussed, including:
Figure 2. Introductory of Education’s Teaching Material

The preparation of introductory educational teaching materials is manifested in mind mapping. Mind mapping is one of the most revolutionary learning methods or concepts in the world of education. Mapping is a technique that utilizes the entire brain by using visual imagery and other graphic infrastructure to form impressions (Swadarma, 2013). According to Buzan (2003), mind mapping is used to develop thinking ability which is initially one direction, into several directions, and can place various thoughts from various points of view. According to Joyce & Weil (1980), mind mapping is "a model of teaching is a plan or pattern that can be used to shape curriculums, to design instructional materials, and to guide instruction in the class room and other settings". According to Buzan (2003), the use of mind mapping will: 1) make it easier to remember numbers, facts and formulas, 2) make it easier to remember and memorize things, 3) increase concentration and motivation. Meanwhile, according to Swadarma (2013) in his book, he writes that there are several experts who play an important role in the development of mind mapping, including:
## II. RESEARCH METHOD

The method used in this research is Research and Development or R&D. The R&D method is carried out in several steps, and has several commonly used methods, including: descriptive, evaluation and experimental. Especially for the evaluation method, it is used to evaluate the trial process of developing research products. Development research generally has two objectives, namely to develop products and test the effectiveness of the product to achieve the final goal. According to Sugiyono (2010: 298) the R&D research method has 10 stages, but due to limitations experienced by researchers due to a pandemic which results in students being unable to perform offline learning, there are only 6 (six) stages, namely:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3rd century Neoplatonist philosophers</td>
</tr>
<tr>
<td>2</td>
<td>compile a mind mapping from Aristotle’s data grouping concept</td>
</tr>
<tr>
<td>3</td>
<td>modify mind mapping into a simple model with a circle finger shape</td>
</tr>
<tr>
<td>4</td>
<td>the concept is used by people to analyse and make solutions to various problems</td>
</tr>
<tr>
<td>5</td>
<td>European scholars in medieval times</td>
</tr>
<tr>
<td>6</td>
<td>develop the concept of mind mapping, namely &quot;Disc Lullian&quot;, with the subject in the centre of the circle</td>
</tr>
<tr>
<td>7</td>
<td>Lullian disc is used to organize various ideas in the form of lines, so that all possible perspectives can be seen more</td>
</tr>
<tr>
<td>8</td>
<td>develop mind mapping for use in the world of education</td>
</tr>
<tr>
<td>9</td>
<td>use a systematic diagram with the keyword which is the centre of the theme placed in the middle</td>
</tr>
<tr>
<td>10</td>
<td>nicknamed the &quot;Father of Modern Mind Mapping&quot;</td>
</tr>
<tr>
<td>11</td>
<td>In the 1960s, there appeared someone who wrote a lot about the &quot;human brain&quot; and learned that humans are born with millions of times the power of computers.</td>
</tr>
<tr>
<td>12</td>
<td>linking the concept map-style mapping technique with the radian thinking theory that exists in the human brain</td>
</tr>
<tr>
<td>13</td>
<td>Tony Buzan (1960-an)</td>
</tr>
<tr>
<td>14</td>
<td>develop mind mapping for use in the world of education</td>
</tr>
<tr>
<td>15</td>
<td>use a systematic diagram with the keyword which is the centre of the theme placed in the middle</td>
</tr>
<tr>
<td>16</td>
<td>nicknamed the &quot;Father of Modern Mind Mapping&quot;</td>
</tr>
<tr>
<td>17</td>
<td>In the 1960s, there appeared someone who wrote a lot about the &quot;human brain&quot; and learned that humans are born with millions of times the power of computers.</td>
</tr>
<tr>
<td>18</td>
<td>linking the concept map-style mapping technique with the radian thinking theory that exists in the human brain</td>
</tr>
</tbody>
</table>

Figure 3. Father Founding History of Mind Mapping
**Figure 4. Research Stage**

Sources of data of this research were from three sources, firstly from the results of the students’ needs analysis during observations in introductory education courses, secondly from students’ needs analysis in order to obtain mind mapping teaching materials that can help facilitate students’ understanding of the material in the course, and third. derived from the results of tests that have been conducted by experts and small-scale tests conducted with 30 students. There are four research instruments used, namely: 1) open interviews with students to obtain initial data, 2) a questionnaire containing statements to obtain the substance of the needs for teaching materials development, 3) product validation test sheets for the three experts to obtain results validation to get research products that are valid and suitable for use, and 4) test instruments to determine the effectiveness of the products that have been produced, namely mind mapping teaching materials. Data collection techniques in this study were interviews, questionnaires and documentation. Interviews were conducted at the beginning of the observation with students to find out the need for developing teaching materials that could help students understand the material easily. The questionnaire technique used the substance of the development of teaching materials, and documentation techniques to document all activities or stages of this research. The analysis technique used in this research is descriptive qualitative which is used to analyze data and information that has been obtained from the results of interviews, questionnaires as well as test results by experts.

### III. FINDINGS, DISCUSSION, AND CONCLUSION

The existence of teaching materials is very important to support teaching and learning process. Existing teaching materials must be in accordance with the needs of students, especially new students. There are several aspects that must be considered in order to prepare teaching materials according to your needs, namely:

---

**1. Observation of Potentials and Problems**
- Field observation
- Analysis of theoretical and practical material in the Introduction to Education course
- Documenting and analysing relevant previous research

**2. Product Design Mind Mapping Teaching Materials**
- Arranging the material that becomes the discussion based on the results of observations
- Compiling plans for learning activities

**3. Product validation of teaching materials by experts**
- The validation test of the resulting product, namely teaching materials in the form of mind mapping, was carried out on 3 experts, namely material experts, media experts and linguists.

**4. Product Revisions**
- At this stage, after the product is assessed or validated by experts, the next step is to make revisions or improvements based on input and suggestions from experts, so that it is more perfect and can be used in learning.

**5. Mind Mapping Teaching Materials Product Results**
- It is a product resulting from research that will be used in introductory education courses.

**6. Product Trial**
- The sixth stage is a limited trial of the products that have been produced. Conducted on students in a small scale test. Due to the pandemic that has hit especially Indonesia, and the appeal not to crowd or gather with large numbers of people, the small-scale test was only attended by 30 student representatives.
a. Content eligibility. The content or material in the teaching materials must be in accordance with the material required in the introductory education course. In this aspect, it consists of six points, namely: 1) material sources, 2) material coverage, 3) material types, 4) material characteristics, and 5) material content.
b. Presentation of material. Presentation of material in teaching materials must pay attention to: 1) systematic presentation of material coherently, b) there are instructions for use, 3) there are illustrations that make it easier for readers to understand, 4) accompanied by case examples, 5) there is evaluation at the end of each discussion, 6) include explanation of terms and, 7) bibliography.
c. Language. In teaching materials, you should use standard language or in accordance with good and correct Indonesian, communicative language and terms that are easy to understand.

Figure 5. Mind Mapping of Teaching Material CHAPTER 3
The results of the validation test involving three experts in accordance with their fields, namely Dra. Suhartatik, M.Pd as a language expert, Wilyanti Agustina B., S.T, M.Pd as a media expert and Dr. Endang Sumarti, M.Pd as the first material expert, and the second material expert is Drs. Nur Rohman, M.M. of the four experts, the mean value is obtained:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Language Expert</th>
<th>Media Expert</th>
<th>Material Expert 1</th>
<th>Material Expert 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Score</td>
<td>84.5</td>
<td>86.2</td>
<td>87</td>
<td>86.3</td>
</tr>
<tr>
<td>Sum of Mean Score</td>
<td>86</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Small-scale trials were carried out on 30 students, based on the initial score as well as the final test score. In order to know the difference, a difference test was carried out by comparing the mean of a variable and using independent sample test data analysis and the value obtained was derived from the data on the results of the tests carried out, it was known that from the similarity of the values of the two variables obtained F = 1.853 and sig = 0.177 = 17.7% (> 5%). It can be interpreted that the results of this study H0 are accepted, which means that the two samples have the same variable. The next test used the Equal Variance Assumed test, and it was found that sig=0,000 = 0% <5%. H0 is rejected, which means that the two population have different mean completeness values. From the test results above, it can be concluded that the mind mapping teaching material falls into the excellent criteria and it is feasible to be used.

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AUTHORS

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The Calibration Model for Predicting Non – Invasive Blood Glucose Levels by Using the Principal Component of Quantile Regression

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Abstract- Diabetes mellitus (DM), a chronic metabolic disorder, is caused by which the pancreas does not produce enough insulin (a hormone that regulates blood glucose) or of which the body cannot use the insulin which is produced effectively. If it is not immediately prevented or addressed, DM will induce to complications leading to death. One of the preventive actions is to check blood glucose levels regularly. Checking blood glucose levels is usually conducted in invasive ways such as by injection and a glucometer which injure the body, take a long time and spend a big expense. Based on those phenomena, the IPB bio marking team is motivated to develop a non-invasive blood glucose monitoring device that is non-injurious for the body. The development of this blood test requires the calibration analysis model. This model can be used to analyze the relationship between invasive and non-invasive blood glucose levels. The principal component of quantile regression calibration model was utilized in this case. The data used in this study were invasive and non-invasive blood glucose collected from 118 respondents in 2017. The result of the study showed that the model with a quantile of 0.70 was good for predicting non-invasive blood glucose levels with RMSEP value of 0,0852.

Index Terms- calibration model, diabetes mellitus, non-invasive, quantile regression

I. INTRODUCTION

Diabetes mellitus (DM), a chronic metabolic disorder, is caused by which the pancreas does not produce enough insulin (a hormone that regulates blood glucose) or of which the body cannot use the insulin which is produced effectively. As a result, there is an increase in the concentration of glucose in the blood (hyperglycemia). If it is not immediately prevented or addressed, DM will induce to complications leading to death. Indonesia is the sixth-biggest country having problem with DM in the world after China, India, the United States, Brazil, and Mexico. In addition, [9] states that the number of adults from the world's population suffering from diabetes is estimated to increase from 150 million in 2000 to 300 million in 2025. This estimate makes diabetes one of the global health problems with the fastest-growing emergency in the 21st century [3]. This problem requires preventive actions, including checking blood glucose levels regularly [9].

Furthermore, checking blood glucose levels is usually conducted in invasive ways such as by injection and a glucometer which injure the body, take a long time and spend a big expense. Based on those phenomena, the IPB bio marking team is motivated to develop a non-invasive blood glucose monitoring device that is non-injurious for the body. The development of this blood test requires the calibration analysis model. According to [5], the multiple variable of calibration model has a function of finding the relationship both measurement units that can be obtained through a relatively easy or inexpensive process and measurement units that require a long time and are expensive. The goal of calibration model is to find the good relationship so that expensive measurements can be predicted quickly, are highly accurate but clearly inexpensive, and spend less money and time. The calibration model in this developed non-invasive device is purposed to determine the relationship between invasive and non-invasive measurements in predicting blood glucose levels. [6] conducted a calibration model by comparing the principle component of regression method, the partial least squares regression and the support vector regression in predicting non-invasive blood glucose levels. The study showed that there were outlier data on the results of measuring invasive blood glucose levels. However, the outlier data were omitted since they have different roles. According [7], outliers can play a positive or negative role in the decision-making process, depending on the type of the case. The outlier data in this case cannot be simply omitted, because there is a suspicion of which a patient has a blood glucose level that is extremely higher than the normal blood glucose levels.

Moreover, in this case the quantile regression method can be applied since the method is flexible in data modeling, especially when extreme values are such important issue [1]. However, calibration modeling requires to reduce the variables first because in general, the calibration data is high multi collinear of explanatory variables [8]. The method that can be used to solve this problem is the principal component analysis. The model of the principal component analysis has the highest sensitivity values so that it can increase the accuracy of the model [4]. This study aims to build a calibration model between invasive and non-invasive blood glucose measurements in predicting non-invasive blood glucose by the principal component of quantile regression.

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II. METHOD

A. Data

The data used in this study are primary data as parts of the research “Calibration Model Through a Continuous Wavelet Transformation Statistical Model, Robust Partial Least Squares Regression, Gaussian Process Regression for developing the Non-Invasive Monitoring System for Patients with High Blood Glucose Levels” by the Non-Invasive bio marking team, Bogor Agricultural University (IPB). Data was taken from April 2016 to January 2017 with a total of 118 respondents who were students from various departments at IPB. Variable Y is the result of invasive measurement in the form of blood glucose levels (mg / dL). Variable X is the result of non-invasive measurement in the form of a spectrum of residual light intensity toward the time domain.

How the non-invasive way works is by irradiating the fingers with an infrared wavelength of 1600 nm (Figure 1). The result of this irradiation is the intensity of light of which it is passed by the limbs. The light is captured by the sensor in the form of a continuous analog voltage value. This value is transformed into a discrete digital voltage value through the Analog-Digital Converter (ADC) which is then processed by the Fast Fourier Transform (FFT) algorithm to produce a time-domain spectrum toward light intensity displayed on a Liquid Crystal Display (LCD). The output of this device is known as the residual light intensity toward the time domain.

The level of light (modulation) on non-invasive measuring instruments is well designed to modulate 0, 10, 20, 30, 40, 50, 60, 70, 80, and 90 with which each modulation is repeated five times. Modulation 0 means the lights off; modulation 10 is 10.85% of the lights on, the rest is off; modulation 20 is 21.70% of the lights on, the rest of the lights is off; modulation 30 is 32.55% of the lights on, the remaining lights are off; modulation 40 is 43.44% of the lights on, the rest lights are off; modulation 50 is 54.25% of the lights on, the rest is off; modulation 60 is 65.10% of the lights on, the rest lights are off; modulation 70 is 75.95% of the lights on, the rest is off; 80% modulation is 86.80% of the lights on, the rest is off; modulation 90 is 97.65% of the lights on, the rest is off.

B. Procedure of Analysis

Data analysis procedures were determined by using Microsoft Excel and R 4.0.2 software using the caret, rpart, and quantreg packages. The analysis steps in this research are:

1. Exploring the results of invasive blood glucose measurements.
   a. Accomplishing the descriptive statistical analysis.
   b. Identifying any extreme (outlier) blood glucose levels.
2. Preprocessing data which are obtained from non-invasive blood glucose measurements by summarizing the spectrum domain in each period that has been well organized with a time of 500 ms. The immensity formula used is the immensity of the trapezoid with the following equation:

   \[ X = \sum_{i=0}^{n_t-1} \frac{(t_{i+1} - t_i)(w_i - w_{i+1})}{2} \]

   Information:
   - \( X \) = The immensity of the period curve for each replication (Cdns)
   - \( t_i \) = i-th time domain (ns)
   - \( w_i \) = residual value of the i-th light intensity (Cd)
   - \( n_t \) = number of time domain ranges

   The summarizing is done because each replication in the modulation has a different number of residual points of light intensity toward the time domain for each respondent (Figure 2).
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III. RESULT

A. Data Exploration

The measurement of invasive blood glucose levels was accomplished at the Prodia Laboratory, which is located at Jl. Jend. Sudirman No. 38 B, Bogor 16143. The data from the measurement are presented in (Figure 3), showing that most of the respondents had blood glucose levels less than 90 mg / dL with a small variety and that there were several outliers on the data. The blood glucose levels of respondents who became outliers included 95 mg / dL, 96 mg / dL (three respondents), 103 mg / dL (two respondents), 104 mg / dL, 105 mg / dL, 115 mg / dL, 116 mg / dL, 123 mg / dL and 276 mg / dL. The results of the descriptive statistics show that the average blood glucose level of the respondents was 82.64 mg / dL. In addition, the lowest blood glucose level was 67.00 mg / dL, while the highest blood glucose level was 276.00 mg / dL. This research was conducted without discarding outlier data.

The exploration data of non-invasive measurement (Figure 4) is the 79th respondent's data of the third test. The graph shows that modulation 0 to modulation 40 tends to be more constant than modulation 50 to modulation 90. Kania (2020) states that modulation 50 to modulation 90 has a significant residual value, so this study only uses modulation 50 to modulation 90.
The models that had been built were then predicted by using the 20% test data. The prediction results of these models were tested by using the Root Mean Square Error of Prediction (RMSEP) value. The model with the lowest RMSEP value was chosen as the principal component quantile regression calibration model for the non-invasive prediction of blood glucose levels. Table 1 shows the RMSEP values at various quantiles.

C. Goodness of Fit

The models that had been built were then predicted by using the 20% test data. The prediction results of these models were tested by using the Root Mean Square Error of Prediction (RMSEP) value. The model with the lowest RMSEP value was chosen as the principal component quantile regression calibration model for the non-invasive prediction of blood glucose levels. Table 1 shows the RMSEP values at various quantiles.

\[ y_{\tau} = 81,2404 - 0.3117 \text{PC1} + 1,4379 \text{PC2} + 0.7977 \text{PC3} - 0.2064 \text{PC4} - 2,1938 \text{PC5} - 0.9506 \text{PC6} - 0.8697 \text{PC7} - 2.0940 \text{PC8} + 0.2673 \text{PC9} - 2.3708 \text{PC10} - 2.4591 \text{PC11} \]

\[ y_{\tau} = 82,1232 - 0.2861 \text{PC1} + 2,0448 \text{PC2} + 0.6990 \text{PC3} - 0.0163 \text{PC4} - 1.6540 \text{PC5} - 1.2220 \text{PC6} - 0.9565 \text{PC7} - 2.1353 \text{PC8} - 0.2230 \text{PC9} - 2.8943 \text{PC10} - 1.9122 \text{PC11} \]

\[ y_{\tau} = 83,1845 - 0.2486 \text{PC1} + 2.6386 \text{PC2} - 0.1908 \text{PC3} - 1.6354 \text{PC4} - 0.7232 \text{PC5} - 1.1123 \text{PC6} + 0.8370 \text{PC7} - 2.3713 \text{PC8} + 1.4850 \text{PC9} - 2.7538 \text{PC10} + 0.3477 \text{PC11} \]

\[ y_{\tau} = 85,2691 - 0.2006 \text{PC1} + 3.0334 \text{PC2} - 0.3078 \text{PC3} + 1.7545 \text{PC4} + 0.7908 \text{PC5} - 2.6889 \text{PC6} - 0.6438 \text{PC7} - 2.1602 \text{PC8} + 0.3755 \text{PC9} - 2.5799 \text{PC10} + 1.7203 \text{PC11} \]

\[ y_{\tau} = 86,2339 - 0.1417 \text{PC1} + 3.1772 \text{PC2} + 0.2389 \text{PC3} + 0.5759 \text{PC4} + 0.7785 \text{PC5} - 3.8377 \text{PC6} - 0.4624 \text{PC7} - 2.5204 \text{PC8} - 0.3533 \text{PC9} - 1.4551 \text{PC10} + 1.6622 \text{PC11} \]
Table 1 The results of the model virtue test

<table>
<thead>
<tr>
<th>Quantile</th>
<th>RMSEP Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.60th Quantile</td>
<td>1.0686</td>
</tr>
<tr>
<td>0.65th Quantile</td>
<td>0.3047</td>
</tr>
<tr>
<td>0.70th Quantile</td>
<td>0.0852</td>
</tr>
<tr>
<td>0.75th Quantile</td>
<td>2.6781</td>
</tr>
<tr>
<td>0.80th Quantile</td>
<td>3.8323</td>
</tr>
</tbody>
</table>

Table 1 shows that the principal component quantile regression model with the 0.70th quantile had the smallest RMSEP value, which was 0.0852, so it can be concluded that the model is good at predicting non-invasive blood glucose levels. The best quantile is also influenced by the distribution of data. Figure 4 shows that the data overfilled above the median (sloping right). This is one of the best quantile selection factors in the model.

IV. CONCLUSION

The result of the study showed that the characteristic data of a good quantile regression calibration model for predicting non-invasive blood glucose levels which were based on the summary data on period immensity and the principal component analysis (95% cumulative diversity proportion) was a model with a quantile of 0.70.

REFERENCES


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Project Implementation in New Public Management Era: Cases from the Constructions Projects in the Public University System in Sri Lanka

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classifying them in terms of stakeholder satisfaction. The study revealed that lack of strategic orientation and management approach, selection of inappropriate procurement methods, insufficient cash flows, and changes in leadership were the most common factors for poor project implementation. However, the study also found evidence to suggest that there has been an improvement in the performance of construction projects in public sector following the NPM reforms.

Keywords: New Public Management, Public University System, Construction Projects

I. INTRODUCTION

Sri Lanka has relatively a larger public sector and it plays a major role in the welfare of its people(Kumara &Handapangoda, 2008). Further, the Government Investment in both economic and social infrastructure development has a significant impact on Foreign Direct Investment inflows to the country (M.F.Marsook, 2018). Public sector needs to be managed more effectively and efficiently because of its larger size in respect of economy and its importance in relation to welfare of the people. Sri Lanka has achieved high scores in human development indicators such as expectancy of life at birth and literacy rate. Presently, average literacy rate and life expectancy at birth are 92.5% and 74.3 years respectively (CBSL, 2014). Sri Lanka has achieved a higher progress than the other nations in the South Asian region and presently ranked in 73rd position out of 187 countries (UNDP, 2014).

The role of the government in the provision of higher education in Sri Lanka is indispensable and of great importance. 24,540 students have been admitted to undergraduate courses as internal students for 2013/2014 academic year. This number covers only internal students admitted to 14 universities, 03 campuses, and 05 higher educational institutions coming under the purview of the University Grants Commission (UGC) (Admission Handbook, 2013/2014). Rs. 20,490.00 million was allocated to the University Grants Commission for the recurrent and capital expenditure of universities and higher educational institutions (UGC Annual Report, 2012).

Government of Sri Lanka took major steps in 1977 by opening the economy and handing over many of the tasks performed by the government institutions to private sector (Kumara &Handapangoda, 2008). This is part of major reforms taken place in the public sector of Sri Lanka. The reforms coincided with the global phenomenon of New Public Management (NPM). Accordingly, Sri Lanka too has taken steps to implement NPM initiatives (Samaratunge and Bennington, 2002). This research studies the level of implementation of NPM in state universities and their influence at project success.

The post-conflict environment in Sri Lanka has presented a great opportunity for higher education sector to become an internationally recognized center of higher education in the region. This was the aim of the Ministry of Higher Education and Highways as its vision was to become a center of higher excellence in higher education. In order to make this aim into reality infrastructure development priorities had been identified and funds were allocated. As a result a lot of construction projects were initiated in almost all the state universities. Those projects are seemed significant in the context of higher education for two reasons. First, projects need to be effective and efficient in order to create world class infrastructure needed to position Sri Lanka as an international hub of higher
excellence in higher education in the region. Second, construction projects utilize huge sums of public fund that is more demanding in view of ever expanding budget deficit and foreign debt of Sri Lanka. Thus, state university governance needs to be implemented properly to make sure that infrastructure development projects are implemented more and efficiently. Related work in other industries have shown strong relationships in goal setting, self-evaluation, participation for the appraisal process, appraisal interview, pay for performance (S.T. Ahamed, et.,al, 2018)

There are several construction projects that are reported to have been poorly planned or implemented citing various reasons. Several projects initiated within the university sector are also reported to have poorly performed. For instance, there are several projects which have been designed without adequate fund. There are also projects which have been designed without giving due consideration to fund availability. Further, several projects have been poorly implemented without meeting deadlines, cost and specifications requirements. This project is aimed to identify the key factors involved in construction projects in the public university.

II. OBJECTIVES

- To examine the best practices of implementing high value projects and develop a rules and regulations, and procedures adopted by state universities in approving and implementing construction projects.
- To analyze the factors that are promoting and undermining the effectiveness of construction projects in state universities to recommend remedial measures that can be taken to improve the effectiveness and efficiency.

II. METHODOLOGY

A. Selection of Population and Sample

This project is mainly having qualitative data. This study explored four cases from Sri Lankan state university sector. Presently there is no comprehensive database containing information with regard to all the projects implemented or being implemented in the university system. Accordingly, the cases and interviewee were identified during data collection stage. Two numbers of extreme cases each for most successful and most unsuccessful cases were identified.

The first interview was held with the Engineer at the University Grants Commission and it was the initial point of data collection. Cases and interviewees were selected based on the findings revealed from that interview. Construction projects with significant impacts were taken into consideration for the purpose of this study. One case was selected for its highly positive contribution. The other two cases had been selected to present the most unsuccessful project scenarios. Fourth case was selected for its high positive contribution with some shortcomings. Altogether four cases had been studied in the project.

B. Data Collection

Time, estimate, specification, client and user satisfactions, free from defects, absence of any legal claims and proceedings, learning and exploitation were used as the indicators for measuring the performance a construction project. Data for the case studies was collected using multiple sources. The research was carried out through a process of document analysis, un-structured and semi-structured interview. Semi-structured interview were conducted based on an interview guide, which had a series of questions designed to cover the study area. The interview guide was developed based on the conceptual framework that reflects the existing literature related to research question.

Interview was the main source of data collection in this study as it is the most suitable method for studying the issues of project implementations and the level of adoption of New Public Management Principles in an organization. Interview technique is used to gather information in a situation where the phenomenon cannot be directly observed (Ekanyake, 2014). Information related to the implementation of New Public Management reforms, and observations and experiences of the respondents project implementations were collected during the interview.

Interviews took about 30 to 45 minutes. Hand written notes were taken. Interview guide was generally followed in asking questions. But there were some exceptional occasions where questions in the interview guide were not asked if the interviewee had given the response for such questions in replying to some other questions.

Fifteen semi-structured interviews were conducted. The interviewees were carefully selected so as to ensure that they represent different stakeholder. The participants of the study are students, Registrar, Heads of Capital Work Departments in universities, Works Engineers, Hostel Sub Wardens, Director / Infrastructure Development of the Ministry of Higher Education and Highways, students etc.

In addition data were also drawn from multiple sources such as published books, journal articles, written reports, newspaper, relevant project proposals and memorandum etc. This helped in preparing the interview guide and validating the information collected during the interview.

C. Data Analysis

Analysis of qualitative data is performed by a process of three steps of summarization, classification, and interpretation (Ekanyake, 2014). The information collected from interview, documentary evidence, and observations was first summarized and each case scenario was developed. Secondly, the relative positions of the projects were identified in the Project Satisfaction Matrix given below in fig 01. Positive and negative features of the projects individually and collective were identified. As a final step of data analysis, conclusion and recommendations were made from the data collected.

D. Measurement of level of success of construction projects

Four indicators were developed in order to measure the success achieved by construction projects in the university sector. These indicators are cost, time, client requirement, and stakeholder satisfaction.

The projects identified are classified according to a project satisfaction matrix shown in the following figure.
E. Project Satisfaction Matrix

<table>
<thead>
<tr>
<th>User’s point of view</th>
<th>Implementer’s point of view</th>
</tr>
</thead>
<tbody>
<tr>
<td>Successful Projects</td>
<td>Successful Projects</td>
</tr>
<tr>
<td>Failed Projects</td>
<td>Failed Projects</td>
</tr>
</tbody>
</table>

Fig 01 - Matrix identifies four categories of projects.

Successful Project: Successful project are those that have fulfilled the expectations of both the users and implementers.

Failed successful project: Projects though successful from the point of view of implementers, it would not have fulfilled the requirements of users.

Successful failed project: Projects those were successful from the point of view of users, but not successful from the point of view of implementers

Failed project: Those projects that have not fulfilled the expectations of both implementers and users.

F. Factors influencing the performance of construction projects

Nine factors were identified as the influential factors affecting the performance of construction project under public management theory. These nine factors analyzed are as follows; management not administration, leadership, focus on result, more strategic approach, improved financial management, flexibility in staffing, competition and contractualism, relationship with politicians, relationship with public

G. Validity and Reliability

Reliability of the data collected in case study methods is very important. Particularly triangulation of the data is very important. Evidences provided were corroborated by at least 03 sources like observation, unstructured and semi structured interview, and documentary evidence to ensure validity of the data collected.

IV. RESULTS AND DISCUSSIONS

Case - 01

The Expeditious Hostel Project implemented in the university system is stated as case-01 in this article. Sixty hostel units have been constructed in 18 higher educational institutions across the county. The cost of one hostel unit is Rs. 200 million. Each unit has 100 rooms. Expeditious Hostel Projects is a quick construction project implemented at a total cost of Rs. 12 Billion to address the issues of lack of accommodation facilities for undergraduate students at universities. Lack of accommodation facilities for undergraduate students was a very serious issue faced by the university system. It was also one of the major challenges which the university system had to meet to improve standards of higher education and increase number students for undergraduate courses offered by the Sri Lankan universities. Further, universities had been spending huge amounts of money as rental for hiring houses or buildings from private owners for the use of students as hostels.

According to Respondents, the lack of accommodation facilities for undergraduate students was a long outstanding issue the university had been facing. Accommodation facilities were not provided to all the students due to limited hostel facilities available in universities. When hostels were not provided, students had to face issues in finding accommodation as there were not enough private houses or buildings for students to rent out.

The initial decision with regard to implementing a mega hostel project in order to address accommodation issues urgently was collectively made by relevant political leaders. Thus, it enjoyed the support of the political leadership.

This was an expeditious project and required to be implemented in the shortest time possible. “Only the basic features of hostels had been included into this project”. The other facilities like electricity, sewerage, plumbing etc… had not been covered into this project as their requirements, and implementation methodologies might differ from one location to other. “Had all other facilities been included into this project, it would not have been possible to implement this project within such a short period of time”. Further, the project had been implemented with a centralized approach.

Uniformity had been maintained in design and implementation in order to attain scale of economies. As a result all the drawings had been identical. Drawings developed for one location had simply been replicated in all the other locations. Identification of requirements and approving of samples had to be done only once. The project had been implemented in 18 higher educational institutions around the country. Had uniformity not maintained, the process of planning, designing, procurement, approving of samples etc. would have had to be done by individual institutions separately. This centralized approach had both saved the time and cost needed to perform such tasks each and every time at different locations by different people. Thus, the project had been planned with some clear strategies. Higher educational institutions with limited resources would not have had the exposure to advanced technical expertise involved in designing this project.

The project had been designed by an international consultant firm. According to Respondents, the hostels had been constructed to an international standard. A team had been nominated comprising the staff from the Ministry concerned and relevant universities to handle this project. A senior staff from the Ministry was in charges of the Project. All works related to procurement had been handled at central level. Engineers from respective higher educational institutions were spearheading the project at institutional level.

This project has been completed within time schedule and without extra cost.

The users at location I of Case – 1 are satisfied with the project whereas the users at location II of the same project are not satisfied. One room is given for only 03 students in location I whereas one room is given for 04 students in location II. Other
facilities in location I had been properly designed to provide better learning environment for students.

Based on the feedbacks of the stakeholders the project is identified as successful project in one location and failed successful project in another location as shown in Fig – 2.

Case – 2

Another construction project implemented in the university system will be stated as case-2 in this article. The works on constructing this building complex had been initiated in 1996. The initial plan was to build a five storied building at the cost of Rs. 290 Million and it had been approved in 2000. The process starting from identifying the project requirements to obtaining the approval had taken about 5 Years. This is a considerable time period and it is quite natural that cost escalates and users change their requirements. According to respondent – 1 “it had been found out that the initial scope is not enough to meet the requirements of the Faculty by the time approval was received”.

Accordingly first revision to the design and cost had been made to the project. It was approved in 2005. The work on the revised project had started in 2007 and followed stage by stage approach in implementing it. However, the piling work had overrun the cost estimate due to some unforeseen works.

By the time, piling works were nearing its completion stage, it had been realized that the balance work could not be completed with the balance allocation available. Respondent - 1 believed “that a mistake should have occurred in estimating the cost during the first revision to the project. Both the implementers and users were not satisfied with the progress of the project by the time the study was carried out. Accordingly, the project is classified as a failed project as shown in Fig – 2.

Case – 3

Another construction project implemented in the university system will be stated as case- 3 in this article. The project had been proposed to address important need of the university while absorbing the future needs too.

According to the result, “the need for a new building complex with larger and more facilities has been felt very badly by the university community”. The building required was to provide enough facilities to the existing students and to facilitate the future expansion efforts of the university. Accordingly, the project had been identified in alignment with the long term requirement of the university.

Relevant stakeholders had involved in the initial project identification and planning stage and had enjoyed top management’s support. Further, the top management had played active role in coordinating the all relevant stakeholders including external stakeholders.

This project was funded by the Government of Sri Lanka and estimated to cost around Rs. 200 million. All procurement related activities were carried out by the line ministry following traditional method. First, Project Consultant had been selected through the National Competitive Bidding procedure. Then the building had been designed. Finally, a contractor had been selected to implement the design.

The actual cost had been much lower than the estimated cost. Some minor changes had also been done to the project utilizing some of the saving. Those additional works had added some extra value for the users while beautifying the building. A Project Manager had also been appointed at the University level. He has been monitoring progress of the project and coordinating the project related activities. Further, he was directly reporting to the Vice Chancellor. Quarterly progress meeting had also been conducted to ensure that the project was progressing as planned, and corrective actions had also been taken whenever deviations from the plan were noticed.

The Project Manager was vastly experienced in the work and looked after the interest of the university in terms of technical requirement.

However, the project had overrun its initial project duration due to extra works requested after the project was awarded, and the Contractor heavy dependence on university’s payments for his cash flow. Noteworthy aspect of this project is that the stakeholders at both ministry and university level are highly satisfied with the outcomes of this project. Accordingly, the project is classified as a successful project as shown in Fig – 2.

Case - 4

Another construction project implemented in the university system will be stated as case - 4 in this article. The first phase of the building was estimated to cost around Rs. 128 millions and approved in September, 1996. The work was awarded in 1997 and had been completed around 2001 at the total cost of Rs. 193 million. The cost escalation is nearly Rs. 65.0 million. The cost revision had been approved in 2001.

The works for commencing the second and final stage of the project had been started in 2001. A new proposal had been prepared at a total cost estimate of Rs. 280 million and it was approved in September, 2004. The project scope had again been changed and the stage – II could not be completed within the estimated cost of Rs. 280 million. The result showed that “there was significant balance works left out of the second stage due to scope change”.

The university had to submit a cost revision proposal at the total cost estimate of Rs. 1016 millions in May 2011 to complete the balance works. However, it had not been recommended for implementation stating that the cost revision was unjustifiable.

Still the balance work had been approved as a separate project at the total cost estimate of Rs. 794 Million in 2013

Though the project is to construct one building, step by step approach had been followed in implementing it. This stage by stage approach is more vulnerable to risks that could arise out of change of scope and cost escalation over time. The age of the project, by the time the study was carried out, was more than 15 years and gone to three stages. The client had added new requirements to the project during the designing stages. They in turn have caused time delay to the project and cost overrun.

Based on the feedbacks of the stakeholders the project is identified as the successful project in one location, and failed
A successful project in another location. It is clearly shown as shown in Fig – 2.

**Fig 02–Identification of projects**

<table>
<thead>
<tr>
<th>User’s point of view</th>
<th>Failed</th>
<th>Successful Projects</th>
<th>Failed Projects</th>
<th>Successful Projects</th>
<th>Failed Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case – 1 (Location - i)</td>
<td>Failed</td>
<td></td>
<td>Case – 2</td>
<td></td>
<td>Case – 4</td>
</tr>
<tr>
<td>Case – 3</td>
<td>Successful</td>
<td></td>
<td>Case – 1 (Location - ii)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Successful</td>
<td></td>
<td>Implementer’s point of view</td>
<td>Failed</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 01 – Positive and Negative aspects of the case studied**

<table>
<thead>
<tr>
<th>Case No</th>
<th>Positive aspects</th>
<th>Negative aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Case 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Strategic orientation: the project had been implemented in alignment to long term vision of the higher education sector</td>
<td>1. Changing of plans</td>
<td></td>
</tr>
<tr>
<td>2. Management approach: Common features of hostel projects identified and designed the project accordingly</td>
<td>2. Less understanding of user requirement</td>
<td></td>
</tr>
<tr>
<td>3. Political support: The project had enjoyed strong support of political leadership</td>
<td>3. Lack of room to incorporate changes to rectify the shortcomings</td>
<td></td>
</tr>
<tr>
<td>4. Leadership: appropriate leadership had been provided at every level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Project monitoring: Close project monitoring and review had been in place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Experienced staff: the project has been designed by qualified consultant and monitored by a project monitoring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Relationship with the users: students have been an important stakeholder in this project.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Focus on delivering results: this has been a main concern</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Case 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Political support: The project had enjoyed strong support of political leadership</td>
<td>1. Lack of strategic orientation: the project has lacked strategic orientation throughout the process</td>
<td></td>
</tr>
<tr>
<td>2. Leadership: It is the prevalence of leadership that had taken necessary decisions to change scopes</td>
<td>2. Changes of leadership: There have been several leaders during the time of this project. Leaders had taken decisions on change of scopes</td>
<td></td>
</tr>
<tr>
<td>3. Project monitoring: Close project monitoring and review had been in place</td>
<td>3. Lack of management approach:</td>
<td></td>
</tr>
<tr>
<td>4. Focus on delivering results: Ongoing stage is being monitored for results</td>
<td>4. Selection of improper procurement method</td>
<td></td>
</tr>
<tr>
<td><strong>Case 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Strategic orientation: strategic location and room to accommodate future requirement as well</td>
<td>1. Contractor’s own financial issue</td>
<td></td>
</tr>
<tr>
<td>2. Management approach: proper identification of requirements and implementation</td>
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<tr>
<td>3. Political support: The project had enjoyed strong support of political leadership</td>
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<td>4. Leadership: committed leadership at university level</td>
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<td>5. Project monitoring: Good project monitoring was exercised at university level</td>
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Management not administration
Projects are to be initiated with clearly identified problem or objectives. This identification of objectives gives a project an overall direction as to what to achieve in the end. Case – 1 has been initiated to find a solution to one of the major issues the university system was facing at that time. Further, the requirements of the project had been identified from the point of view of finding a quick solution to the problem i.e. the ministry had planned to construct hostels within the shortest time possible. The project had been designed and implemented accordingly. Some hostel units have been handed over even before scheduled delivery date. Case – 3 has been initiated to address a real need of the university and it had been initiated in alignment with the long term orientation of the university. It had helped the university to identify requirements and set the objectives very precisely. The project implementation has been very successful. In Case – 2 the requirements identified in the initial stage had been changed later. Initial plan had been to construct a five storied building, but, later it had been found that the facilities included in the initial plan would not be sufficient to meet the requirements of the faculty. Both the scope and estimate had to be revised. Eventually it turned out to be very costly. Scope of the project in Case – 4 had not been properly defined or identified in the initial stage. The scope of the project had been changed later. It resulted in a project design that could not be implemented with the available allocation. It had also turned out to be very costly. Accordingly, identifying requirements and setting the objectives clearly in the early stages of a project helps better project implementation.

Strategic Orientation
Projects need to have strategic orientation for it to be successful and to make significant contribution for an organization. Case – 1 has been initiated to address the accommodation issue that was one of the main stumbling blocks to increase student intake for undergraduate degree program. Further, lack of hostel facilities in university system had been consuming a lot of resource in terms of finance. This requirement has been specifically identified in the Corporate Plan of the Ministry of Higher Education and Highways. Accordingly, Case – 1 had been implemented in alignment to corporate plan. The university system has achieved immense financial saving, and increased its capacity to admit more students for undergraduate programs. Project has provided a conducive environment for students to pursue their studies without the fear of the environment. Initial project scope in Case – 2 had become inadequate within a short period of time as it had not been prepared in alignment to long term objectives of the faculty.

The end result is time overrun, upward cost revision, and under or non utilization of potential resources.

Case – 3 has been initiated to address a real need of the university and it had been in alignment to long term orientation. It had also helped the university to identify requirement and set the objectives very precisely. Case – 3 has increased university’s capacity to provide library facilities for more students.

Flexibility in staffing
Case – 1 has been designed by qualified consultant while its implementation had been monitored by a team of experienced staff nominated from among those working in the university system. The project in Case – 3 had also been designed by a qualified consultant selected through due procedure. The project had been designed by the consultant in consultation with relevant officers in the university. Further, the university focal person had also been an expert in project implementation having gained a vast amount of experience in the field. Thus it is evident that projects need to be implemented by capable people for it to be successful. This is another factor that has contributed for the effective and efficient implementation of Case – 1 and Case – 3. Also, M.F. Hibathul Careem, (2019), reported that leadership style of supervisors strongly influences on the job satisfaction of the construction workers.

Relationship with politicians
Case – 1 had enjoyed the active support of the political hierarchies. It had helped to implement an expeditious project across many higher educational institutions in the country. The political leadership is also a factor, among other, that had encouraged the faculty in Case – 2 to go for the first cost revision. The negative influence arising from stakeholders increases costs and may delay the schedule in projects (Olander and Landin, 2005). Even after it was found that the revised estimate is not enough to carry out the whole works the faculty had managed to get the project moving up to the extent possible. Political leaderships has also been aware of the project and played an important role in sorting out its issues. Government influences projects by way of withholding or limiting resources that a project needs to precede. The means may be labour, funding, permissions or licenses (Sallinen, Ruuska, & Ahola, 2013).

Leadership
Every Project has a unique objective. As such project success depends on achieving the output within its estimated time and cost budgets and in accordance with specifications. (Collins and Baccarini, 2004). Further, a good relationship...
between politicians and officials creates a good understanding of the issues encountered in implementing projects and helps to find speedy solution. Extra works have been easily implemented in Case – 3 due to the improved understanding prevailed between the Ministry and relevant higher educational institution.

The line Ministry itself has provided leadership to Case – 1. It enabled the project to achieve the expected output very easily. Case – 2 has been led by several officials due to its prolonged implementation period.

**Competition and contractualism**

Risk is a common factor that negatively affects projects. It can affect the project at any stage. It can be mitigated if a project is planned properly and precautionary measures are taken. Case – 1 had been designed giving consideration to perceived risks. Many of the risks associated with projects are transferred to contractors if a project is implemented under design and build method.

Case – 2 has been affected due to many unforeseen works such unforeseen extra works in piling and cracking of wall in the adjacent building. Had Case – 2 implemented under the design and build method those risks would have been covered by the contractor without any additional cost. Under traditional method, additional time need to be spent to get approval for extra works. This delay itself would increase the cost due the inflation effect associated with time. Case – 4 has changed its requirements once it was finalized. It had cost the project very heavily.

**Focus on Results**

Decisions made according to long term objectives helps organizations to be more effective and efficient (Bryson, 2004). According to Lefley (2004), “corporate” strategy is concerned with what business the organization is in. The projects activities need to be identified and scheduled for the projects to follow a result oriented approach.

There has been a good project monitoring and control in Case – 01. Phase – 02 of the case – 02 which were started in 2014 are reported as in schedule due to close monitoring. Progress of Case – 3 has been reviewed regularly.

**Improved Financial Management**

Timely payments motivates contractors to perform better towards the project. Case – 01, and Case – 03 had enjoyed good cash flows, and payments had been made without much delay. Liquidity issues of contractors affect projects performance. Tight liquidity position of the contractor in Case – 03 caused the project to overrun the schedule a bit. Payments on interim bills need to be paid without delay for the contractors to perform with motivation. Under design and build method making payments on interim bills are easier as payments are made against the agreed milestones. Employment of an imprudently selected procurement method could be a hindrance to the realization of certain benefits associated, and might eventually lead to project failure (Naoum, 1994). It also leads to cost and time overruns and disputes on projects (Masterman, 1992). In other words, selection of appropriate procurement strategies helps to achieve optimal solutions in terms of cost, time and quality. They also contribute to easily meet the agreed targets (Jagger, 1995).

**Relationship with public**

Undergraduate students being the clients are a key stakeholder group in the university system. The idea of implementing the balance work of case – 2 under Public and Private Partnership had also been dropped due to strong opposition some stakeholders. Having understood the requirement of clients only adequate number of students were allocated for a hostel room, and designed furniture. Thus, the users in location I of the Case – I were satisfied with the outcome of the project.

**V. CONCLUSION**

Projects implemented in accordance to the principles of New Public Management have been very successful. Critical public management factors that are very important for implementing projects are strategic orientation, management approach, and selection of proper procurement method, sufficient cash flow, and leadership.

Implementing large size projects which runs into many years in stages is the most ineffective method. This method has high risks for cost escalation, and are vulnerable to scope changes. The projects designed and awarded as a whole though it runs into many years, are not affected due to price escalation because, the risk of price escalation is transferred to the contractor. Further, it does not allow any scope changes. Thus, Design and Build procurement method has been very effective in the Sri Lankan university system for implementing large size construction projects.

Implementing large, shared, and similar projects at central, by the ministry with the involvement of relevant institutions, is an efficient way of project implementation as it achieves economies of scale.

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The Importance of al- wasatiyyah in Islamic Worldview

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Abstract- Al wasatiyyah is Arabic word which means moderation and balance. Down the centuries, Islam provided an entire life structure that teaches man to follow the middle ground between physical and spiritual needs, balance between worldly life and hereafter and balance between Physical universe, (micro & macro-humans, flora, fauna, inanimate environments) and metaphysical cosmos (angels, heaven, hell, jinn, satan). Thus, Islam as a seal of revealed religions is a belief system that gives to each aspect of human life without any imbalance or exaggeration and never asks people to focus only on the spiritual dimension or on material aspect of their life. It means, one must not be extreme or rigid in one aspect of the world and neglect another dimension, but he should balance his routine activities and worldly affairs, (economic, religious, political and ceremonial activities) with hereafter, on the ground that Islam believes that the healthy life is highly situated in moderate life. Based on this fact, this humble paper aims to explore the importance of moderation in Islamic worldview, with particular reference to moderation in religion. However, For the sake of article, revelation based approach will be applied to carry out this study. Finally, a brief conclusion will be provided, followed by some suggestions and recommendations.

Index Terms- Islam, moderation, religion, Qur’an, Sunnah, Wasatiyyah

I. INTRODUCTION

Islam is the seal of religion of God it deals with human affairs from cradle to death. One of the best characteristics of Islam is moderation which is known in Arabic as “Wasatiyyah” and which means middle and balance in every action of mankind religiously, politically, financially and socially, this implies that, Islam does not tolerate any sort of extremism or fanatism. It sees moderation as the best measure for human activities that will fetch peace, harmony and happiness for people. Base on this tangible fact this humble paper will explore the importance of moderation in Islam with particular reference to moderation in religion that urged by Islam. Therefore, the paper will adopt the revelation based approach to investigate the necessity of balance in religious activity according to the teaching of Islam, and Islam’s abhorrence and condemnation to any kind of extremism.

II. DEFINITIONS

The word “moderation” generally means “Middle” and “to avoid extreme” in every matter. In Arabic, it is known as Al-Wasatiyyah which means excellence, rightfully balanced, just and fair in all aspects. Balance without any excessiveness in human life. It is indeed one of the Islamic Principle. Furthermore, the term al-wasatiyyah is used in the context of the Qur’an to refer to Islamic community which is “ummatan wasatan” which means nation that having attributes of Justice, excellence and balance in order to serve as Allah’s trustworthy “witness over mankind” (Shuudaa ’ala al- Nas) in this world and in the hereafter. In this regard, al-wasatiyyah can also be translated as “justly balanced quality” or “justly balance nature” of Islam and the Islamic community. The more common translation however is moderation. In the most serious note, the term al-wasatiyyah or moderation has become very famous in Muslim talk and lecture today, especially after the incident of September 11 2001 on the United State of America, that resulted to the loss of lives of hundreds of innocent people. Hence several Muslim nations struggle with the religio-political challenges posed by religious extremism, radicalism, fanatism and violence in their respective societies.

According to (Al- Zuhaili, 1991), Al Wasatiyyah is obviously a fundamental trait of Muslim personality that is in line with the objectivity of human creation purposely functioning to flourish in this worldly life with obedience and worshiping the Almighty Allah and being entitle for paradise in the hereafter. Therefore, basically, al-Wasatiyyah or moderation means a complete denial of extremism or a strong condemnation of any kind of radicalism for self interest in the name of religion. Al-wasatiyyah strongly holds the ethical attitude, scrupulous manner to demonstrate the characteristics of justice and balance in a structured and in a scientific manner. It is one of the main characteristic of Muslim Individual’s conduct and Muslim community’s living style, that shape their routine activities in balanced manner in this world and hereafter without any exaggeration or excessiveness.

3 Qur’an, 2: 143
4 Muhammad Kamal Hasan, 2013, The Need to Understand Al-Wasatiyyah
III. QURANIC PRINCIPLE OF AL-WASATIYYAH

As a matter of fact, the meaning of al-wasatiyyah in Quranic worldview and which makes the Ummah suitable to become “witness over mankind” is justice (Al-'adl) which means justice to Allah SWT, justice to religion of Tawhid, justice to human being, justice to creatures, and justice to nature and oneself. Because, Almighty Allah dislikes injustice. According to the holy Qur'an, Allah said

وَكَذَٰلِكَ جَعَلْنَاكُمْ أُمَّةً وَسَطًا لَّيَتَوَكَّلُواْ عَلَى النَّاسِ وَيَكُونُ الَّذِينَ نَزَّلَنَا عَلَيْكُمْ مَبْنِيَّةً شَهِيْدًا وَمَا جَعَلْنَا الْأَلْبَاطَةَ آَلِيَّةً كُتَبَ عَلَيهَا إِلَّا لِتَتَعَالَمُ مِنْ يَتَبَيَّنَ الْرَّسُولُ مِنْ يَمْثِبُ عَلَى عَقِيَّتِهِ وَإِن كَانَتِ الْكَبْرَةُ لَا عَلَى الْذِّينَ حَذَى الْأَلَّهَ وَمَا كَانَ اللَّهُ لِيَضْعَفْ إِلَّا مَا يَشَاءَ يُنَادِي مَنْ كَانَتِ الْأَمْسِكَةُ رَفُوعًا رَجِيمًا

ثُمَّ أَهْلَكْنَا عَدُوَّنَا عَلَى الْأَلْبَاطَةِ إِلَّا مَا كَانَ اللَّهُ لَيَضْعَفْ إِلَّا مَا يَشَاءَ يُنَادِي مَنْ أَهْلَكْنَا عَدُوَّنَا إِلَّا مَا كَانَ اللَّهُ لَيَضْعَفْ إِلَّا مَا يَشَاءَ}

Undoubtedly, justice is a position between two opposing sides, without picking any of the sides and not being bias or prejudice in making judgment or decision, and according to the above passage, this is position of Ummah. Therefore, there is a need for Muslim to become a religious, moral and civilizational witness over mankind, with the attributes of justice and moral excellence as the core attributes. The Qur’an has attested the principle of Justice when Allah says: “

إِنَّ اللَّهَ يَأْمُرُ بِالْإِحسَانِ وَيَنْزِلُ النَّعُومَ وَيُنَذِّرُ الْجَهَّالِينَ وَيَنْهَى عَنِ الْفَحْشَا وَالْمُنْكَرِ وَيُحَذِّرُ عَبْدَيْهِ بِالْعَذَابِ الْمُغَدِّرِينَ وَيُرِيدُ لِلنَّاسِ مَا يُدْخِلُهُمْ مِنْ فُرُوجٍ رَحِيمٍ}

“Indeed, Allah command justice and good conduct and giving to relatives and forbids immorality and bad conduct and oppression. He admonishes you that perhaps you will be reminded”5

IV. AL-WASATIYYAH IN WORLDLY AFFAIRS

Furthermore, al-wasatiyyah principle in the worldview of the Qur’an, extended to balance quality of Muslim between worldly affairs and hereafter. i.e the holy Qur’an which is the seal of the revelations of God invites man to enjoy bounties of Almighty Allah in this temporal world without any excessiveness, and it reminds him not to forget the importance of hereafter i.e man should try to integrate between the transitory world (al-Dunyaa) and everlasting world (Al-Akhirah), in which the dunya-aspect must be related profoundly to the Akhirah-aspect in moderate manner, and in which the Akhirah-aspect has ultimate and final significance. This kind of wasatiyyah is clearly stated in the Qur’an when Allah said that:

5 Al-Qur’an: 2:143
6 Qur’an, Al Nahl: 90
O ye who believe! When the call is proclaimed to prayer on Friday (the Day of Assembly), hasten earnestly to the Remembrance of Allah, and leave off business (and traffic): That is best for you if ye but knew! And when the Prayer is finished, then may ye disperse through the land, and seek of the Bounty of Allah. and celebrate the Praises of Allah often (and without stint): that ye may prosper.\(^7\)

The Principle of \textit{al-wasatiyyah} and integration between worldly affairs and hereafter is again stated in another passage of the Qur’an when Allah said:

\begin{equation}
\text{وَأَبْعَثْ فِي مَا أَنْتَكَ لِلَّهِ الدَّارُ الْأَخَرَةُ وَلاَ تَنسَ نَصِيبَكَ مِنَ الدُّنْيَا وَأَحْسِنَ كَمَا أَحْسَنَ اللَّهُ إِلَيْكَ وَلَا تَبْعِثَ الْفَسَادَ فِي الْأَرْضِ إِنَّ اللَّهَ لَا يُحبُّ}\end{equation}

Al-Muṣtidīn

But seek, with the (wealth) which Allah has bestowed on thee, the Home of the Hereafter, nor forget thy portion in this world: but do thou good, as Allah has been good to thee, and seek not (occasions for) mischief in the land: for Allah loves not those who do mischief.\(^8\)

Hence, the above two passages indicate that the holy Qur’an has valued \textit{al-wasatiyyah}, and invites man to exercise this principle in all dimensions of life, and human should not be too extravagant in his activities in \textit{dunia} and forgetting \textit{al-Akhira}. Based on this fact, it is relevant to say that Islam is truly a religion of \textit{al-wasatiyyah} and moderation.

V. THE IMPORTANCE OF \textit{AL-WASATIYYAH} IN RELIGION (WITH PARTICULAR REFERENCE TO ISLAM)

As we mention earlier, Islam is a religion that gives to each aspect of human life its due without any imbalance or exaggeration. The materials, social, spiritual, cultural, and intellectual aspects of human life are treated in a balance manner. Islam never asks people to focus only on the spiritual dimension or on the material dimension of their life. But it puts each dimension in its right place and legislates the necessary instruction to fulfill and meet the need of that particular dimension of human life. Therefore, this segment will exclusively explore the important of \textit{al-wasatiyyah} and moderation in religion with special reference to Islam. Indeed, it is important to note that, Extremism is not a new phenomenon, it can be found in all religions. With regard to Islamic community, its root can be found in the early history of Islam. As a matter of fact, there have been many extremist schools and sects, which have impact on other extremist groups. These groups have no consideration for the principle of \textit{al-wasatiyyah} and moderation. In this respect, Al-Khawaarij and Al-Murjiah\(^9\) are the best known of early extremist groups. These two groups have gone extreme in their ideology and teaching, as they have deviated from the correct teaching of Islam that holds the principle of moderation. Hence, It is sufficed to say that Islam does not condone any sort of extremism, it rather invites people to enjoy moderation and \textit{al-wasatiyyah}

\textit{Al Murjiah}: They believe that actions are deferred from Iman (al-Irjaa). Thus, actions, according to them, are not part of it. Iman is simply the complying of the heart. The sinner, according to them, is a believer with complete Iman, even if he does what he does from the disobedient acts or he abandons what he abandons from the obedient acts.
The following hadith of the prophet Muhammad (p.b.u.h) is such a perfect example, that indicates the importance of al-wasatiyyah in Islam. Anas narrated, "A group of three men came to the houses of the wives of the Prophet asking how the Prophet worshipped Allah, and when they were informed about that, they considered their worship insufficient and said, "Where are we from the Prophet as his past and future sins have been forgiven."

Then one of them said, "I will offer the prayer throughout the night forever." The other said, "I will fast throughout the year and will not break my fast." The third said, "I will keep away from the women and will not marry forever." Allah's Apostle came to them and said, "Are you the same people who said so and so? By Allah, I am more submissive to Allah and more afraid of Him than you; yet I fast and break my fast, I do sleep and I also marry women."

So, he who does not follow my tradition in religion, is not from me (not one of my followers)." (Al-Bukhari). 10

What a statement! This Hadith proves the importance of exercising al-wasatiyyah in Islam, not only in our social or economic or political fields, but it is also required in the field of religion. Therefore, a true Muslim should refrain from any excessiveness or exaggeration in the worship, (ibadah) or in religion. Indeed, as we argued earlier that extremism is a world phenomena it can be found in all religions, as such, Qur'an as a book of history, has narrated the absence of al-wasatiyyah in some of the followers of the previous religions with particular reference to people of the book (Jews and Christians) who happened to exaggerate in the nature of Jesus the son of Mary. According to the Qur'an

VI. MODERATION IN WORSHIP

Unlike extreme approach of some Jews and some Christians, Islam comes with moderate approach in order to make things easier for mankind. Although one must strictly fulfill its spiritual duties like offering prayers five times a day to get closer to the Almighty, fasting for sake of pleasing the Lord, performing Hajj etc. but one is also excused not to complete such acts being in a state of some difficulty. According to the holy Qur’an:

10 Sahih al-Bukhari

11 Al-Qur’an, 4:171

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O ye who believe! when ye prepare for prayer, wash your faces, and your hands (and arms) to the elbows; Rub your heads with water; and (wash) your feet to the ankles. If ye are in a state of ceremonial impurity, bathe your whole body. But if ye are ill, or on a journey, or one of you cometh from offices of nature, or ye have been in contact with women, and ye find no water, then take for yourselves clean sand or earth, and rub therewith your faces and hands, Allah doth not wish to place you in a difficult situation, but to make you clean, and to complete His favour to you, that ye may be grateful.

It means that if someone has some problem and cannot accomplish the actually required level of cleanliness due to some unavoidable circumstances, there is no compulsion in this matter, and one can do as much as it can, as intentions decide the outcome of the deeds. Moreover, God, the Exalted says that He does not want to create any kind of complexity for us, rather He wishes only what is good for us. In short, the fact of the matter is that in Islam, there is no room for strictness in matters, and one can adopt moderation as much in carrying out religious action as required by it.

VII. MODERATION IN PERFORMING OUR PRAYER

As part of this, we should be moderate in our acts of worship such as prayer, fasting, and even charity. For example, our prayers should be recited in a moderate voice, neither too loud nor too soft. Allah said: “O people, be gentle with yourselves for you are not calling upon one who is deaf or absent. Rather, you are calling upon the Hearing, the Seeing”. (Sahih al Bukhari)

Another example of the application of al-wasatiyyah in performing prayer by Rasulullah is obvious in his leadership of the prayer and Friday sermon. He would lead the prayer and deliver a sermon that were long enough for the people to absorb a meaningful lesson or reminder, but not so long that it would cause boredom or distress. In this regard Jabir ibn Samurah reported: “I was praying with the Messenger of Allah, peace and blessings be upon him, and his prayer was of moderate length and his sermon was of moderate length”. (sahih Muslim)

Regarding voluntary acts of worship, the Prophet encouraged his companions on many occasions to limit their extra worship so that they could take care of their duties to their families as well as maintain their health.

VIII. CONCLUSION

In conclusion, moderation in Islam binds one to adopt sense of balance in every action, whether it is religious or social, individual or collective. Al-wasatiyyah or moderation in all things is the most important advantage in Islam and the Muslim nation is a middle nation in the sense that it uses its full power in building, reforming, gaining profits, educating and teaching in moderate manner without any negligence or extravagance. Al-wasatiyyah is a sense of balance between the individual and the group, between life and religion, between the power of the mind and the power of the body, between idealism and realism, between spirituality and materialism… etc. In nutshell, as far as al-wasatiyyah and moderation in religion is concerned. It is

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12 Al-Qur’an, 4:6
13 Al-Qur’an, 17:110
irreligious and ungodly to exercise extremism which is the act of going beyond the normal or acceptable limit in the name of faith and belief; because Islam as a seal of revealed religions never encourage it, and indeed, extremism and its all manifestations are completely opposed by the teaching of Islam.

IX. SUGGESTIONS AND RECOMMENDATIONS

1. Islam is a religion of al wasatiyyah and moderation; it loves wasatiyyah on the ground that, the survival of human being in this life and hereafter in Islamic worldview, is strongly related to moderation.

2. Extravagant life and extremism are merely the inventions of people, especially some people of the books (Jews and Christians) who deviated from the right teaching of Torah (Taorah) and gospel (Ingil) respectively.

3. The act of extremism or radicalism in religion, exaggerating in worship, overburden in da’wah and Islamic missionary should be condemned in strongest term by the Muslim Ummah, because it is neither the teaching of Islam nor the act of Prophet Muhammad (S.A.W).

4. Muslim leaders, economics, politicians administrators academics, intellectuals, students families etc., Should always exercise this excellent value(al- wasatiyyah) and avoid any sort of extremism in their routine activities, moreover, the individuals, community, schools, media ought to take a leading role in conveying this Islamic value of al-wasatiyyah and condemning the vicious act of extremism in the society.

5. There is a strong need of organizing talks, lectures, debates, workshops and conferences on the importance of moderation and danger of extremism in the society.

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Abstract- Nigeria was identified as one of the countries with the highest rate of forest loss (3.3 percent) in the world. Since 1990, the country has lost 6.1 million hectares or 35.7 percent of its forest covers. It also recorded that Nigerian most biodiversity ecosystem is fast depleting at an unbelievable rate. The aim of this research was to determine the trend, pattern and extent of landuse/landcover change of Guga Forest Reserve in, Shika, Giwa Local Government Area of Kaduna State, Nigeria. The methodology adopted for this research includes using Remote Sensing and Geographic Information (GIS) techniques, Landsat MSS imagery of 1986, Landsat TM imagery of 1990, Landsat ETM+ data of 1999 and Landsat 8 OLI image 2019. The datasets were processed and classified into land use/land cover classes using the supervised classification technique in Erdas imagine 9.2 environment and ArGIS 10.1. The result revealed that between 1986-1990, built-up, agricultural land and water body increased at the rate of 1.7%, 0.6% and 3.8% per annum while forest, and bare land declined at the rate of -0.3%, - 1.2% annually. Between 1990 and 1999, built-up, and agricultural land increased at the rate of 0.9%, 2.3% annually while forest, bare land and water body declined at the rate of -0.2%, -4.1% and -10.4% annually within these same periods. More so, in 1999 to 2019, built-up, agricultural land and water body increased at the rate of 0.9%, 1.2% and 0.2% annually while forest and bare land decreased at the rate of -1.8% and -2.2% per annum. The study concludes that there is high rate of urban encroachment in the Guga forest reserve area. There is serious encroachment of physical development and cultivation on the forest cover. These could be attributed to inadequate monitoring of the forest reserve. If this situation continues at this rate, the vegetation cover in the area would soon be lost to the detriment of the environment. The built-up area and agricultural land have shown a continuous increased within the period of study while forest/vegetation and bare land declined. The research recommends that the management of Guga forest reserve should adopt Remote Sensing and Geographic Information System (GIS) techniques which have proved to be efficient in the monitoring of vegetation cover. This would help to control encroachment and illegal logging in the area and the people should be sensitized through enlightenment campaigns on the consequences of indiscriminate tree felling. Alternative sources of cooking energy should also be emphasized.

Index Terms- Land Use; Land Cover; Change; Rate; Pattern; Environment

I. INTRODUCTION

Otu, Joseph and Eja, (2011) reported that FAO’s Global Forest Resource Assessment (Tanko, 2011) cited in FAO, (2010a; 2010b), estimated that the global forest area currently covers about 4.033 billion hectares and it also report that between 2000 and 2010, the world has lost about 130 million hectares of its forest. Tanko, 2011 cited in FAO, (2011c) report that global forests area will continue to decline. However about one half of the forest that covers the earth is gone. A positive sign is that, the estimated loss of forests area at global level decline from 16 million hectares per year between 2000 and 2010 that is each year 16 million hectares disappear. The World Resource Institute estimates that only about 22 percent of the world original forest cover remain intact-most of this, is in three large areas: the Canadian and Alaska boreal forest, the boreal forest of Russia, and the tropical forest of the Northwestern Amazon Basin and the Guyana shield.

Forests in Africa are extremely diverse. Deforestation and urban population growth have gradually increased together, with heaviest forest losses coming in the area where wood is needed for fuel, construction purposes or where forest land is needed for growing crops (Mortimore, 1970). The forest in Africa currently covers about 23 percent of the land; it was reported that 75 million hectares of forest land (10 percent of the total forest area) was converted into other land uses between 1990 and 2010 (Aroins, 1998; FAO, 2011c; Danburi, 2014; Zubair, 2016; Turner, et. al., 2017).

According to Cunningham and Cunningham (2004), an estimated 12.5 million km2 of tropical land were covered with closed canopy forest a century ago and 9.2 million hectares or about 0.6 percent of the remaining tropical forest is cleared each year. This situation occurs as a result of over exploitation due to high demand for food, energy and fodder and through illegal logging and non-replacement of the natural vegetation; people have decided to use firewood as an alternative means of energy for domestic purpose. Another dimension is added by felling and burning of wood to produce charcoal and this is causing serious depletion of the forest resources (Okonkwo, Umar, and Nwafor; 2002; Tanko, 2011; Danburi, 2014).
In the loss of biodiversity according to World Fact Book (2012), Nigeria was identified as one of the countries with the highest rate of forest loss (3.3 percent) in the world. Since 1990, the country has lost 6.1 million hectares or 35.7 percent of its forest covers. It also recorded that Nigerian most biodiversity ecosystem is fast depleting at an unbelievable rate. For example, between 1990 and 2005, Nigeria lost an average of 409,700 hectares of forest every year equal to an average deforestation rate of 2.38 percent. As of 2005, Nigeria has the highest rate of deforestation in the world according to Food Agriculture Organization of the United Nations (FAO, 2010b). The significant effect of loss of forest/vegetation is the exposure of bare surfaces to disaster such as erosion, pollution and consequently climatic change with an adverse effect on both physical and human environment (Sheyi, 2004; Zubair, 2016; Turner, et. al., 2017).

Forest Reserves

Forest Reserves are areas designated by the government for the protection of timber and other forest resources. Harvesting of timber may be allowed under permit and under special concession to people in the surrounding community. Harvested timbers are mostly replaced with exotic trees species. Most of these Forest Reserves are also poorly managed by the various state ministries of Agriculture and natural resources (Usman and Adefalu, 2010; Danburi, 2014; Zubair, 2016).

The first Forest Reserve in Nigeria is the Otolokemej reserve established near Ibadan around 1900 (Onokerhoraye, 1985; Tanko, 2011). This was followed by the establishment of other Forest Reserve in various parts of what forms the present-day Nigeria. In these reserve, lumbering activities where made illegal. By 1908, a Forest Ordinance promulgated by the colonial government gave protection to all commercial timber outside the reserves.

In 1917, the first definitive government policy on forestry came into existence. In that year, the then governor, Lord Lugard, stated that each province of the country must reserve a minimum of 25% of its forests. This policy statement later faced lots of opposition in the eastern part of the country. This was because of the high population density and the resultant higher pressure on land (Egbok, 1979).

At the time of independence in 1960, many Forest Reserves were already in place in the country. Many of these Forest Reserves were to later become Game Reserves. For instance, the Yankari Game Reserve which was opened in 1962 was a forest reserve for some time (Onokerhoraye, 1985). From about 800 Forest Reserves and about 30 Game Reserves in the 1980s, the number of the forest reserves in the country has now increased to 966. There are also eight National Parks, twelve strict Nature Reserves and 28 Game Reserves in the country today (Areola, 1982; Federal Government of Nigeria, 2001).

The indiscriminate felling of trees has continued in virtually every part of the country. For instance, the Federal Department of Forestry (2001) estimated that Nigerian forests are being depleted at an annual rate of 3.5%. Nigeria used to have about 20% of its area covered by natural forests but these have been reduced to about 10%. It lost about 60% of its natural forests to agricultural encroachments, excessive logging and urbanization between the 1960s and the year 2000 (FAO, 2001). In some areas natural forest has been totally replaced with monocultures of exotic trees. Indiscriminate felling of trees has continued in both the high forest and savannah areas which have resulted to serious reduction in timber resources.

There is the fear that what is left of the forests and the wildlife may be completely lost within the next few years if care is not taken. The rate of afforestation continues to be far slower than the rate of exploitation (Tanko, 2011; Danburi, 2014; Turner, et. al., 2017).

II. METHODOLOGY

Reconnaissance Survey

A reconnaissance survey was carried out in the area to enable the researcher to get familiar with the state and nature of the forest/vegetation cover in the study area.

Types of Data

In order to achieve the aim and objectives of this study, the types of data used for the study were satellite imageries, Administrative map, and topographic map of the study area at a scale of 1:40,000.

Sources of Data

The primary data used for the research are mainly satellite images acquired from National Centre for Remote Sensing in Jos and these include the following:

i. Landsat Multispectral Scanner (MSS) of 7th December, 1986 with a spatial resolution of 79meters.

ii. Landsat Thematic Mapper (TM) of 27th November, 1990 with a spatial resolution of 30meters.

iii. Landsat Enhanced Thematic Mapper Plus (ETM+) of 19th October, 1999 with a spatial resolution of 30meters.

iv. Landsat 8 (OLI) of 20th October, 2019 with a spatial resolution of 30meters.

The extent of the change of the forest covers within the study periods:

To determine the extent of forest change in the study area, the forest cover layer for the periods of study were extracted from the land use/land cover classified images and the statistics were generated, showing the extent of the changes that have occurred over time.

The trend and pattern of the forest change in the study area over these periods

To achieve this objective, the percentage and rate of forest change in the area in kilometers as derived from the classified image statistics were used. The area change of forest was ascertained by subtracting the former area coverage of the forest from the latter. The change in square kilometers (observed change) = the area coverage of forest of the recent image minus the area coverage of forest of the previous image.

Percentage change was however determined by dividing the observed change by the changes in latter years (base year) multiplied by 100.
Observed change x 100
Percentage change (rate) = \ \frac{\text{Base year}}{\text{No. of Study year}}

To obtain the annual rate of change in the forest, the percentage of the change of the forest was divided by the study period.

Annual Rate of change = \frac{\% \text{Change}}{\text{No. of Study year}}

III. RESULT AND DISCUSSIONS

Rate and Pattern of Land Use/Land-Cover Change
The rate and pattern to which each land use/land cover class is changing per year however is tabulated in hectares and percentage as shown in the Table 1:

Table 1: Annual Rate of Land use/Land cover Change

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ha</td>
<td>%</td>
<td>Ha</td>
<td>%</td>
</tr>
<tr>
<td>Bare land</td>
<td>-17.3</td>
<td>-1.2</td>
<td>-54.3</td>
<td>-4.1</td>
</tr>
<tr>
<td>Built up</td>
<td>3.9</td>
<td>1.7</td>
<td>2.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Agric/land</td>
<td>13.8</td>
<td>0.6</td>
<td>58.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Forest</td>
<td>-2.0</td>
<td>-0.3</td>
<td>-1.3</td>
<td>-0.2</td>
</tr>
<tr>
<td>Water</td>
<td>1.6</td>
<td>3.8</td>
<td>-4.8</td>
<td>-10.4</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2020

The analysis as shown in Table 1 revealed that, between 1986-1990, built-up, agricultural land and water body increased at the rate of 1.7%, 0.6% and 3.8% per annum while forest, and bare land declined at the rate of -0.3%, -1.2% annually. Between 1990 and 1999, built-up, and agricultural land increased at the rate of 0.9%, 2.3% annually while forest, bare land and water body declined at the rate of -0.2%, -4.1% and -10.4% annually within these same periods. More so, in 1999 to 2019, built-up, agricultural land and water body increased at the rate of 0.9%, 1.2% and 0.2% annually while forest and bare land decreased at the rate of -1.8% and -2.2% per annum.

In general, between 1986-2019, the built-up and agricultural land increased at the rate of 0.9%, 1.5% per annum within the period of study. On the contrary, forest, bare land and water body were declining at the rate of -1.0%, -2.1 and -3.3% per year. Going by this rate, if no adequate measure is put in place to monitor and protect the forest reserve, it may be lost completely.

The Extent of Built-up Land
The extent of built-up land within these study periods is shown in Fig. 1 and Fig. 2. Table 1 shows the extent of the urban expansion between the various time periods.
Fig 1: 1986 Built-up Map of the Study Area
Source: Field Survey, 2020

Fig 2: 1990 Built-up Map of the Study Area
Source: Field Survey, 2020
Fig 3: 1999 Built-up Map of the Study Area  
Source: Field Survey, 2020

Fig 4: 2019 Built-up Map of the Study Area  
Source: Field Survey, 2020
The results shown in Table 2 revealed that, between 1986-1990 the built-up area increased to about 7.0%, while in 1990-1999, it increased to about 8.2%. By 1999-2019, there was a dramatic increase in built-up to about 24.3%. The Shika area was growing at the rate of 0.9% within the period (1986-2019) studied. Between 1999-2012, about 19.4 hectares of land which amounted to about 7.5% was added to built-up land use and within these same periods it recorded an annual growth rate of about 0.5%. In other word about 1.2 hectares of land was built-up yearly at that period.

More so, the evidence of this urban expansion could be seen in built-up map of the study area in Fig. 1, 2, 3 and 4 above. The improvement or rather increase in the built-up area could be attributed to the relocation of the teaching hospital to its permanent site which triggered the need for people to acquired land to built on, this also attracted lot of commercial activities in this area. A lot of people could afford to build their own houses. This mounted pressure on the land and consequently, built-up land use increased at the detriment of other land cover types in the area as seen in the figures. This means that the rate at which the land-use was increasing is attributed to increase in human population over time.

**Vegetation Change**

The extent of forest change from 1986 to 2019 is shown in Figs. 4. Table 3 shows the extent to which forest has been loss between the various time periods.

<table>
<thead>
<tr>
<th>Period</th>
<th>Year</th>
<th>Forest (Ha)</th>
<th>Change</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ha</td>
<td>Ha/Year</td>
</tr>
<tr>
<td>1986-1990</td>
<td>1986</td>
<td>673.1</td>
<td>-7.8</td>
<td>-1.2</td>
</tr>
<tr>
<td>(4years)</td>
<td></td>
<td>1986</td>
<td></td>
<td>-2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>%</td>
<td>%/Year</td>
</tr>
<tr>
<td>1990-1999</td>
<td>1990</td>
<td>665.3</td>
<td>-1.8</td>
<td>-0.2</td>
</tr>
<tr>
<td>(9years)</td>
<td></td>
<td>1990</td>
<td></td>
<td>-1.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>%</td>
<td>%/Year</td>
</tr>
<tr>
<td>1999-2019</td>
<td>1999</td>
<td>653.3</td>
<td>-26.7</td>
<td>-1.8</td>
</tr>
<tr>
<td>(20years)</td>
<td></td>
<td>1999</td>
<td></td>
<td>-11.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>%</td>
<td>%/Year</td>
</tr>
<tr>
<td>1986-2019</td>
<td>1986</td>
<td>673.1</td>
<td>-28.8</td>
<td>-1.1</td>
</tr>
<tr>
<td>(33years)</td>
<td></td>
<td>1986</td>
<td></td>
<td>-6.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>479.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2019</td>
<td></td>
<td>194.0</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2020

The results as shown in Table 2 reveal that the forest land decreased from -7.8 hectares in 1986 to 1990. The forest land was declining at the rate of - 0.3% within the period (1986-1990) studied. The period between 1990 and 1999 recorded a loss in forest land of about -12.0 hectares and was decreasing at the rate of -0.2% per annum. More so, from 1999 to 2019, about -174.2
hectares of forest land which amounted to about -26.7% was loss annually, the period recorded an annual growth rate of about -1.8%. In other word about -11.6% hectares of forest land were loss to built-up yearly at that period.

Generally, the period between 1986 to 2019, about -1.1% of the forest was loss to other land use type. The result indicates that each year the forest land is been loss giving room to urban expansion as shown in Table 3 above. The period 1990-1999 recorded the highest decreased in forest land with an annual growth rate of - 0.2%.

IV. CONCLUSION AND RECOMMENDATIONS

Conclusion
This study reveals high rate of urban encroachment in the Guga forest reserve area. There is serious encroachment of physical development and cultivation on the forest cover. These could be attributed to inadequate monitoring of the forest reserve. If this situation continues at this rate, the vegetation cover in the area would soon be lost to the detriment of the environment. The built-up area and agricultural land have shown a continuous increased within the period of study while forest/vegetation and bare land declined.

Recommendations
Based on the identified changing nature and rate of various land-use/land-cover types identified in the study area especially from 1986 to 2019, the following are recommended:
- The management of Guga forest reserve should adopt Remote Sensing and Geographic Information System (GIS) techniques which have proved to be efficient in the monitoring of vegetation cover. This would help to control encroachment and illegal logging in the area.
- The people should be sensitized through enlightenment campaigns on the consequences of indiscriminate tree felling. Alternative sources of cooking energy should also be emphasized.

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Factors that Affect the Success of Search and Rescue Missions: Perceptions of Search and Rescue Crews of Malaysian Police Air Wing

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¹Aviation Fitness Cluster Universiti Kuala Lumpur Malaysian Institute of Aviation Technology
²European Paratroopers

Abstract- The Malaysian Police Air Wing has a Search and Rescue Unit that actsuates Search and Rescue using aircraft and aviation related equipment. The personnel involved are trained professionals with vast experiences. This paper investigated the factors that contributed to the success of Search and Rescue Missions in lieu with aircraft, equipment, experiences, and management. The results were mixed and several initiatives were proposed to mitigate existing predicaments.

Index Terms- Aviation Search and Rescue, Search and Rescue Crews, Management Responses

I. INTRODUCTION

In Search and Rescue (SAR) missions, several factors contributed to the success of the missions. SAR roles are to search for victims and rescue them. Environments, such as extreme weather, high winds, and others, also played a role in the actuation of the missions. According to Polka, for a SAR mission to be successful, the organization that was responsible for the SAR should be equipped with state of the art equipment and vehicles [1]. Polka also mentioned that a well oiled methodology was also needed to perform seamless SAR operations [1].

Bogue stated that in the light of current situation it is best to consider new technology and equipment for SAR purposes [2]. Bogue even stipulated that it was imperative to gain requirements from stakeholders in order to utilize proper and appropriate equipment for SAR [2]. We found this interesting and important as the research from Bogue had fueled us to actuate our research pertaining to equipment of SAR (this is part of this paper).

Cokorilo had investigated components of SAR and she stated that the type and number of aircraft needed for SAR were gravely important and these acted as factors that decided the success of SAR missions [3]. Cokorilo also went further and had analyzed accident statistics where this had gave an overall view of the SAR ecosystem [3].

We had postulated that in SAR it was important for SAR management to act swiftly and response quickly to alerts in SAR in order to gain successful SAR missions. We had posed this situation to our respondents and their responses were shown in the Results Section of this paper. Braga agreed with us and he stated that in any organizations and industry, it’s vital for responses from management be swift and delivered efficiently so that the objectives were met [4]. Braga also iterated that this should be integrated into the culture of most organizations in order to maintain continuity and consistency [4].

For our research, we had used the 4 Point Likert Scale to gain responses from the SAR Crews of the Malaysian Police Air Wing. Willits had pointed out that the usage of Likert Scale was valid and through various literature reviews and analyses Willits concluded that any condemnations of the scale were bogus and invalid [5]. Willits also affirmed that the scale could be used to extract vital information from the respondents or individuals [5].

Sullivan had analyzed in great details the utilization of Likert Scale and she pointed out that the scale was widely used for assessments of workers and was hugely popular in the educational field [6]. Sullivan stipulated that the scale was utilized by various medical organizations that gauged patients satisfactions and others [6]. With this, our approach in the utilization of the Likert Scale was valid and in complete agreement with others in various fields.

II. LITERATURE REVIEW

Aviation Search and Rescue is important as it saves lives and contributes to the recoveries of assets and people. Aronica had concluded that SAR is a combination of personnel, tools, vehicles, and others that work in concert to accomplish a mission [7]. Aronica had developed an application that aided the SAR missions by calculating the most appropriate path to be taken to conduct the SAR [7].

Harridon had stipulated that in SAR the most vital entity was the selection of the aircraft to be used where the selection should be based upon performances of the aircraft during SAR missions [8]. This is actually part of Management of SAR Operations where good management would entail appropriate decisions were made to select the best aircraft, equipment, and resources. Harridon further opined that proper selection would reduce wastage during SAR operations and would impart significant efficiency throughout the missions [8].

Koester acknowledged that SAR is important and he had produced a new algorithm that conducted SAR in a much efficient manner [9]. With this advent, those involved in SAR were not confronted with wastage in terms of time or resources.
[9]. We applauded this effort and our research dwell upon this matter which was term as “facilities” since “facilities” encompassed physical and non physical entities (such as search algorithm and methodology).

According to the National Search and Rescue Committee (NSARC), it is imperative for agencies involved in SAR to be equipped with aircraft which are suitable for SAR operations and their numbers should also be adequate [10]. NSARC also commented that these aircraft should be in suitable conditions, ready to fly when alerts are received [10].

In a review of SAR operations, Jacobs stated that there were insufficient number of SAR aircraft in the Alaskan Region and this was detrimental to those that resided or worked in that particular region [11]. Jacobs further recommended that aircraft and other SAR equipment be added to bases or agencies that acted SAR in that region [11]. Jacobs was particularly sympathetic towards workers in the Oil & Gas industry that worked in perilous environment at the Alaskan Region [11]. We agreed with this issue and we posed this issue to the SAR crews of the Malaysian Police Air Wing and the responses were mixed.

Another issue of SAR was regarding the prompt responses from management when SAR alerts were received. Williams had gone through several cases where he studied responses from management and he stipulated that it was vital that responses from management be quick and without any delay [12]. He was concerned on the confusion and havoc that were created due to non responsiveness from management [12]. We portrayed this issue to the crews of Malaysian Police Air Wing and the portrayal was via 4 Point Likert Scale.

Jia had used the Likert Scale to compare cultures from different countries [13]. Jia had collected data of students from universities across 16 countries and the collection was via Likert Scale [13]. Jia stated that the Likert Scale was able to perform the comparison and was satisfied with the outcome [13].

Chimi explained that the utilization of Likert Scale had provided advantages in terms of comprehensive analyses [14]. Chimi also stated that the scale had the ability to capture hidden meanings and topics which were sensitive were easily discerned by the scale [14].

Janda had also used Likert Scale for her research pertaining to native language [15]. She had applied the scale to measure the nuances of the native speakers and had given the speakers several verbs in order to capture the responses from the speakers [15]. We can evidently observed that the application of Likert Scale was myriad in numerous different circumstances and this somehow validated our usage of the scale in capturing the responses of the SAR crews of the Malaysian Police Air Wing.

III. METHODOLOGY

Figure 1 showed the methodology of our research.

![Figure 1. Our Research Methodology](image)

Through heuristic we had identified 2 factors that contributed to the success of missions of SAR. Those 2 factors were “facilities & aircraft” and “responses from management”. Facilities were denoted as physical facilities and non physical facilities (such as search methodology and axiom). These 2 factors were integrated with the 4 Point Likert Scale and we portrayed them to the SAR crews of the Malaysian Police Air Wing.

We had calculated the minimum required number of respondents where the calculation was based upon the Sample Size Equation. The following values were inserted into the equation: population size = 253, confidence level = 80%, and margin of error = 5%. The population size is the total number of SAR crews at the Malaysian Police Air Wing. The calculation revealed that we needed 100 respondents and we had gained that 100 respondents which met the minimum requirement. We had also interviewed the SAR crews with regards to their experiences. Their experiences were required as these were used to aid our analyses of the responses from the Likert Scale. We went further where we had calculated the Cronbach Alpha of our responses and factors and we had gained a value of 0.7082. This showed that our method was acceptable, consistent, and had sufficient reliability. It had to be noted that the responses which consisted of “strongly agree”, “agree”, “disagree”, and “strongly disagree” were denoted as 1, 2, 3, and 4 respectively in order to calculate the Cronbach Alpha value.

The responses were represented in graphical forms and analyzed. Discussions and conclusions were actuated based upon the responses and also were cross checked against the experiences of the SAR personnel. This gave credence to our analyses, discussion, and conclusion.
IV. RESULTS

The results are shown in Figures 2, 3, 4, 5, and 6.

**Figure 2. Experiences of Crews**

![Experiences in Search & Rescue](image)

**Figure 3. Facilities and Aircraft**

![Facilities and Aircraft for Search and Rescue Operations are Sufficient](image)
Figure 4. Agreement & Disagreement - Facilities & Aircraft

Figure 5. Responses From Management
Figure 6. Agreement and Disagreement - Responses from Management

V. DISCUSSION

Peering at Figure 2, it can be seen that majority of the SAR crews (84%) had more than 10 years experiences. This was an exceptionally good figure as the SAR operations were performed by individuals that were well versed in SAR and had the fortitude to handle emergencies that existed. Only 4% of the crews had experiences between 1 till 5 years. This seems to be a concern but we managed to get hold of information which indicated that new crews were properly trained before they were allowed to be part of the SAR operations. Also experiences here also mean the ability of the SAR crews to use appropriate methods and tools to maintain their physical fitness. Crews that had enormous experiences were able to identify the appropriate method to enhance their fitness level. Harridon had studied the realm of physical fitness in the field of Aviation and results of the study had shown that high level of physical fitness is important in maintaining safety and delivering outputs [16]. Harridon also stated that physical fitness is a continuous process that should be ingrained in one’s culture [16].

In Figure 3, the crews were posed with the statement “the facilities and aircraft for SAR missions were adequate”. A great number had disagreed (53%) and 25% of the crews had strongly disagreed. Only 11% agreed and 11% strongly agreed. This was a grave issue where the majority had stated that the facilities and aircraft were not in sufficient manner in terms of numbers and appropriateness. This should be taken seriously as majority of the crews with more than 10 years experiences had deemed it so. Those with extensive experiences would know best, hence we proposed a review upon the budgetary constraints of the organization in order to acquire more aircraft and improve current facilities.

In Figure 4, we had posed an issue regarding responses from management when SAR alerts were received. 91% of the crews strongly agreed that swift and quick responses from management were needed in order to increase the chances of finding the victims and saving lives. 9% of the crews also agreed with this notion. It had to be stated that SAR crews of different degrees and levels of experiences were in unison for responses be actuated in a prompt and quick manner. Its plausible that all crews were indoctrinated to act swiftly during emergencies where this indoctrination was done during basic SAR training.

In Figure 5 we had posed an issue regarding responses from management when SAR alerts were received. 91% of the crews strongly agreed that swift and quick responses from management were needed in order to increase the chances of finding the victims and saving lives. 9% of the crews also agreed with this notion. There were no disagreements regarding this. It had to be stated that SAR crews of different degrees and levels of experiences were in unison for responses be actuated in a prompt and quick manner. Its plausible that all crews were indoctrinated to act swiftly during emergencies where this indoctrination was done during basic SAR training.

In Figure 6, which showed the holistic representation of agreement and disagreement, it can be observed that 100% of the SAR crews were in agreement that fast responses were needed from management. It would be best if those in management were integrated with the hands-on crew so that they could produce decisions on the spot during SAR alerts. This means those in management were also required to be on call in order to facilitate the decision making processes.

VI. CONCLUSIONS

We had gauged the responses of the SAR crews of the Malaysian Police Air Wing. Factors that affected the success of SAR missions were aircraft, facilities, and responses from management. Data and analyses indicated that facilities and aircraft had to be in appropriate manner in terms of numbers and appropriateness. Responses of SAR management were also vital and had to be prompt in order to actuate actions early so that victims could be located in a timely manner and lives could be saved.
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Students’ Attitudes and Approaches towards Physics Problem Solving: Basis for Intervention Program

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Abstract: Learning problem-solving abilities is among the most vital issues of physics curriculum, although it is the zone where learners get the most difficulties. It is considered a challenging matter for students in the secondary to tertiary level of education. Assessing students’ attitudes and solutions to address Physics problems is important in determining which strategies must be used by teachers to handle these situations and in encouraging students to find a more interesting point of view of physics and not to stress or feel worried as they have learned the principle of physics. This study assessed and measured the attitudes and approaches towards Physics Problem Solving of the 50 twelfth grade students. A descriptive research design using an adopted survey questionnaire was used in the study. The results of the study revealed that the attitude and approaches of the learners in Physics Problem Solving were generally described as; somewhat aware on the process of problem solving and take control on the process that leads them to enjoyment (M=3.83); utilize sometimes pictures, illustrations, or scratch works in solving physics problems (M=3.79); somewhat perceive approaches in solving problems (M=3.85); classified themselves as “novices” as they immediately substitute formula into numbers rather than understand first the given problems (M=3.83); understand the application of the problem-solving process in real world set-up (M=3.81); and they are confident enough and sometimes feel sophisticated in solving problems in physics (M=3.74). This evaluative study will be used in planning and devising the appropriate teaching strategy to implement inclined to students’ different approaches.

Keywords: students’ attitudes and approaches, physics problem solving

Introduction

Physics is well thought out to be the most difficult discipline in the field of science and traditionally fascinates a limited percentage of students relative to other branches of science. It is regarded as a complicated subject for learners from secondary to higher education. This is partly due to the learning processes involved in studying physics, which enable learners to deal with various types of diagrams, such as formulas, equations, diagrams, depictions, and also conceptual comprehension at the existential level (Saleh, 2014). In addition, learners are engaged in a pact to solve problems. Teaching problem solving is one of the most serious matters of teaching physics, and it is also the area where students have the most difficulties.

The 2002 Basic Education Curriculum postulates that the purpose of science education is to enable every Filipino learner to gain a practical scientific literacy linked to real-life circumstances, to achieve the scientific knowledge, values and attitudes needed to analyze and solve daily social problems. When attempting to solve the problems of physics, students always say that they understand the issues, they understand the facts of physics upon which issue is centered, they have solved several similar problems, but the new problem is different from the previous ones, so they cannot solve the problem.

Educational policies today strive to improve individuals with 21st century skills perceived to be universal necessity and problem-solving skills is one of the skills that emerged as a prerequisite of the 21st century. However, at the same time, the prevailing issue in schools is that students have a bad attitude, which makes the learning process severe. In order to address this issue, it is necessary to explore the attitude of students towards teaching physics not only in senior high school but also in junior high school.

Enabling successful learning for students is the main goal of education that is affected by few factors, such as the attitude of students towards learning and the characteristics of the learning environment (Al-Qahtani, 2012). Extensive research has shown that a person’s behaviors are learned rather than inherited, including past experiences and social factors. Many factors can affect a person’s attitude, including past experiences and social influences. Cracker (2006) described an attitude towards science as a positive or unfavorable feeling about science as a school subject.

The influence of students’ attitudes and approaches to solving Physics problems is critical in deciding which techniques must be implemented by the teacher to deal with this situation and in helping students to find a more interesting topic of physics and not to fear or worry as they have studied the concept of physics. A pessimistic attitude towards the subject leads to a lack of interest in attending and engaging in any activity related to the subject. Thus, a positive attitude towards science, however, leads to a positive interest to science that affects sustained interest to learn in science (Ricardo, 2006).

Teachers play a crucial role in the lives of students in their classrooms. Beyond that an educator has many other responsibilities, such as mentoring and nurturing students, creating a healthy classroom atmosphere, being a role model and, most importantly,
setting students' moods to inspire them to be involved and value learning. Research demonstrates that the effectiveness of the instructor has an effect on the academic success of his or her students. It is crucial that teachers trust in themselves and their competence as positive examples and teachers, since they have a critical part to play in the self-perception and success of their students. A positive attitude towards teaching and learning to solve problems in physics is then a key to increase students' incentive to follow healthy learning habits. In addition, students will need to make efforts and refine their negative attitudes.

Physics educational research has described behaviors and values of students as leading to higher academic achievement (Mistades, 2011). The attitude of learners to one subject or another has been shown to lead to good performance in this subject. A negative attitude towards a certain subject makes learning challenging, while a positive attitude allows students to make efforts and contributes to a high level of achievement in the subject (Veloo, et. al, 2015). Godwin and Okoronka (2015) have shown that there is an important relationship between the attitude of students and their subsequent academic success in physics. Measuring the attitude of students to the subject is therefore a valuable activity if one wants to enhance the performance of students in the subject.

With these in mind, the researchers performed a report that had a meaningful effect on the education system. The current study filled the knowledge gap and reacted to the behaviors and approaches of senior high school students to the Physics Problem Solving program and will serve as a framework for action or creativity. In this context, the results of the surveys identified the issues to be addressed and whether there are changes and innovations that will allow learners to achieve successful quality education.

The research was based on cognitive learning theory. In which the person learns through thought. It can be explained by observing the individual's mental processes. The use of the Attitudes and Approaches in Problem Solving Survey (APPS) questionnaire was considered to be the input of the research, while the conduct of the survey was considered to be the method and the formulation of the intervention / innovation program based on the findings was the output of the research.

The figure below shows the Paradigm of the study.

```
Input
Survey Questionnaire

Process
Survey Data Analysis

Output
Intervention / Innovation Program
```

In this study, it sought to determine and assess Senior High School Students’ Attitudes and Approaches towards Physics Problem Solving. Specifically, the research questions address in this study are as follows:

1. How do Senior High School Students’ Attitudes and Approaches towards Physics Problem Solving be described in terms of;
   1.1. Metacognition and enjoyment
   1.2. Utility of pictures, diagrams or scratch work
   1.3. Perception of problem-solving approach
   1.4. General expert-novice differences
   1.5. Sense-making
   1.6. Problem solving confidence and sophistication

2. Based on the results, what may be suggested?

Methods

A quantitative approach has been adopted in this research as it is a systematic method of identifying and evaluating the attitudes and approaches of senior high school students to the Physics Problem Solving method, using the numerical and analytical data obtained from the respondents’ responses to the questionnaires.

The researchers used a descriptive research design to create a detailed analysis. This type of research design identified the current conditions and other relevant details of the topic in the analysis. By definition, Salaria (2012) defined the descriptive method as an analytical process of collecting, evaluating, classifying and tabulating data on prevailing circumstances, behaviors, attitudes, procedures, patterns, and then providing an appropriate and accurate analysis of the data collected.

The sample of this study consisted of 50 Twelfth Grade Students on the academic and technical-vocational and subsistence paths of Grade 12 of Sta. Maria High School. Respondents of the research were selected randomly using a stratified random sampling. Below is a table that shows the percentages of the respondents.
Table 1 shows the Distribution of the Respondents.

<table>
<thead>
<tr>
<th>Strata/Section</th>
<th>Population</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genesis</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Exodus</td>
<td>29</td>
<td>9</td>
</tr>
<tr>
<td>Leviticus</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Numbers</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Deuteronomy</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Joshua</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>154</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

This research adopted the survey questionnaire entitled, Attitudes and Approaches in Problem Solving (AAPS). It consists of 31 statements explaining various facets / factors for solving physical problems such as: metacognition and enjoyment, use of photographs, diagrams or scratches, understanding of problem-solving approach, general expert-novice discrepancies, sense-making, and problem-solving trust and complexity. Using the 5-point related scale, the respondents were directed by how they would agree / disagree on the corresponding statements in the survey form.

The data collected in this study was treated and analyzed using the Microsoft Excel and Stata 11 Software Program which is a statistical software designed for easy tabulation. In analyzing the collected data, appropriate statistical treatment was used; Arithmetic Mean, to find out the average of a set of numerical values, computed by adding them together and dividing by the number of terms and to determine the senior high school students’ attitudes and approaches in solving problems in Physics.

**Results and Discussion**

This study focused on determining the senior high school students’ attitudes and approaches towards physics problem solving in terms of the 6 facets/factors (metacognition and enjoyment, utility of pictures, diagrams or scratch work, perception of problem-solving approach, general expert-novice differences, sense-making, and problem-solving confidence and sophistication). The findings of the study were presented in tables together with verbal descriptions and interpretations.

**Metacognition and Enjoyment in Problem Solving**

Metacognition implies that critical thinkers become mindful of their own problem-solving process, take charge of this process, and seek assistance whenever necessary. Metacognition questions talk about what students do as they solve problems and their level of satisfaction and trust when they solve problems.

It is evident on the table below that senior high school students’ metacognition and enjoyment on problem solving is generally weighted with 3.83 which indicates that students are somewhat aware on the process of problem solving and take control on process which leads them to enjoyment.

<table>
<thead>
<tr>
<th>No.</th>
<th>STATEMENTS</th>
<th>Arithmetic Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>In solving problems in physics, I always identify the physics principles involved in the problem first before looking for corresponding equations.</td>
<td>3.96</td>
</tr>
<tr>
<td>6</td>
<td>In solving problems in physics, I can often tell when my work and/or answer is wrong, even without looking at the answer in the back of the book or talking to someone else about it.</td>
<td>3.32</td>
</tr>
<tr>
<td>7</td>
<td>To be able to use an equation to solve a problem (particularly in a problem that I haven't seen before), I think about what each term in the equation represents and how it matches the problem situation.</td>
<td>3.64</td>
</tr>
<tr>
<td>10</td>
<td>If I am not sure about the correct approach to solving a problem, I will reflect upon physics principles that may apply and see if they yield a reasonable solution.</td>
<td>3.82</td>
</tr>
<tr>
<td>13</td>
<td>If I used two different approaches to solve a physics problem and they gave different answers, I would spend considerable time thinking about which approach is more reasonable.</td>
<td>3.96</td>
</tr>
<tr>
<td>14</td>
<td>When I solve physics problems, I always explicitly think about the concepts that underlie the problem.</td>
<td>3.72</td>
</tr>
<tr>
<td>20</td>
<td>After I solve each physics homework problem, I take the time to reflect and learn from the problem solution.</td>
<td>3.98</td>
</tr>
<tr>
<td>21</td>
<td>After I have solved several physics problems in which the same principle is applied in different contexts, I should be able to apply the same principle in</td>
<td>3.88</td>
</tr>
</tbody>
</table>
The research published by Netto and Valente in 1997 cited by Ince (2018) looked at the effects of students using cognitive knowledge techniques to overcome their physical problems. In this semi-experimental research, the problem-solving abilities of secondary school students were examined using problem-solving interventions, including cognitive awareness strategies. The results of the study indicated that students who applied cognitive awareness techniques to problem-solving behavior were better at problem-solving.

Taasoobshirazi and Ferley’s research published in 2013 looked at the relationship between the motives of professional problem solvers, the ability to use metacognition methods, the ability to categorize problems, and the ability to use free body diagrams to solve physical problems. According to the findings of the analysis, clarified by the structural equation model, the motivation variable strategy affects metacognitive preparation and problem categorization, and the strategy of competence and problem categorization increases the ability to solve problems.

**Utility of pictures, diagrams or scratch work in Physics problem solving**

It is apparent on the table below that senior high school students’ utilization of illustrations in solving problem is generally weighted with 3.79 which indicates that students sometimes use pictures, diagrams, and scratch work whenever they solve problems in Physics.

<table>
<thead>
<tr>
<th>No.</th>
<th>STATEMENTS</th>
<th>Arithmetic Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>When solving physics problems, I often find it useful to first draw a picture or a diagram of the situations described in the problems.</td>
<td>3.78</td>
</tr>
<tr>
<td>17</td>
<td>I am equally likely to draw pictures and/or diagrams when answering a multiple-choice question or a corresponding free-response (essay) question.</td>
<td>3.82</td>
</tr>
<tr>
<td>18</td>
<td>I usually draw pictures and/or diagrams even if there is no partial credit for drawing them.</td>
<td>3.72</td>
</tr>
<tr>
<td>19</td>
<td>I am equally likely to do scratch work when answering a multiple-choice question or a corresponding free-response (essay) question.</td>
<td>3.82</td>
</tr>
<tr>
<td></td>
<td><strong>General Weighted Mean</strong></td>
<td><strong>3.79</strong></td>
</tr>
</tbody>
</table>

In 2001, Zou discussed the effect of using graphics in the field of work-energy on the problem-solving skills of students. In a study conducted with 3 Physical Problem Solutions and Interviews, he stated that with the use of graphics, students could better understand the principles on which the problem was based, create equations more specifically, and better assess the solution of the problem. In addition, Kohl and Finkelstein (2005) studied the impact of statistical, pictorial, visual and descriptive presentations on students’ problem-solving skills in the field of physics. In this work, which was carried out semi-experimentally with homework, including these 4 dimensions, which are mathematical, pictorial, graphic and expressive, it has been reported that students can solve the problems indicated by visual gestures more easily.

On the other hand, Yiğit et al. (2012) examined the capacity of science students to read the problems in physics classes and to deliver correct results on paper. The research, using a screening model, was conducted with 40 students. To this end, 5 open-ended questions were used and the responses were categorized according to the student's ability to turn texts into shapes and describe shape-based texts. The results of the study showed that the students were unable to understand what was mentioned and what was asked in the questions posed in text and type.

**Perception of problem-solving approach**
The table below shows that senior high school students’ perception of problem-solving approach is generally weighted with 3.85 which specifies that students somewhat perceive approach as a component or part of the problem-solving process.

<table>
<thead>
<tr>
<th>No.</th>
<th>STATEMENTS</th>
<th>Arithmetic Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>&quot;Problem solving“ in physics basically means matching problems with the correct equations and then substituting values to get a number.</td>
<td>4.2</td>
</tr>
<tr>
<td>8</td>
<td>There is usually only one correct way to solve a given problem in physics.</td>
<td>3.7</td>
</tr>
<tr>
<td>9</td>
<td>I use a similar approach to solving all problems involving momentum even if the physical situations given in the problems are very different.</td>
<td>3.6</td>
</tr>
<tr>
<td>11</td>
<td>Equations are not things that one needs to understand in an intuitive sense; I routinely use equations to calculate numerical answers even if they are non-intuitive.</td>
<td>3.86</td>
</tr>
<tr>
<td>12</td>
<td>Physics involves many equations each of which applies primarily to a specific situation.</td>
<td>3.86</td>
</tr>
<tr>
<td>26</td>
<td>It is more useful for me to solve a few difficult problems using a systematic approach and learn from them rather than solving many similar easy problems one after another.</td>
<td>3.88</td>
</tr>
<tr>
<td></td>
<td><strong>General Weighted Mean</strong></td>
<td><strong>3.85</strong></td>
</tr>
</tbody>
</table>

 Özcan’s study released in 2011 examined at the problem-solving methods of pre-service physics teachers to address the problems of special relativity theory. In this study with 34 university students, two problems and semi-structured interview questions were used to define problem-solving methods for students. The findings of the study showed that the problem-solving activity of most pre-service teachers was not scientific or did not provide an effective strategic approach.

In 2012, Abubakar and Danjuma discussed the effect of an explicit problem-solving approach (focusing on the problem, identifying the problem, preparing for a solution, executing the plan, and assessing the solution) on academic achievement and remembrance of students. The Solomon quartet was used in this research, which they performed with 80 high school students. The physics efficiency test developed by the researchers themselves was used as a means of measurement. Based on the results of the three-dimensional study of variance, this approach is the best approach to boost the academic performance of students in high school physics classes and to enable them to recall past experience.

**General expert-novice differences in physics problem solving**

It is reflected on the table below that senior high school students’ expert-novice differences in physics problem solving is generally weighted with 3.83 which explains that students are somewhat be classified as “novices” since they simply attempt to plug or substitute numbers into formula rather than first try to understand the problems.

<table>
<thead>
<tr>
<th>No.</th>
<th>STATEMENTS</th>
<th>Arithmetic Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>There is usually only one correct way to solve a given problem in physics.</td>
<td>3.7</td>
</tr>
<tr>
<td>21</td>
<td>After I have solved several physics problems in which the same principle is applied in different contexts, I should be able to apply the same principle in other situations.</td>
<td>3.88</td>
</tr>
<tr>
<td>24</td>
<td>When I have difficulty solving a physics homework problem, I like to think through the problem with a peer.</td>
<td>3.84</td>
</tr>
<tr>
<td>28</td>
<td>I try different approaches if one approach does not work.</td>
<td>3.86</td>
</tr>
<tr>
<td>29</td>
<td>If I realize that my answer to a physics problem is not reasonable, I trace back my solution to see where I went wrong.</td>
<td>3.96</td>
</tr>
<tr>
<td></td>
<td><strong>General Weighted Mean</strong></td>
<td><strong>3.83</strong></td>
</tr>
</tbody>
</table>

Dhillon (1997) examined variations in the problem-solving behavior of expert and inexperienced problem solvers. The research included 1 teaching staff at the Faculty of Physics, 2 Physics Department PhD students, 4 Physics Department Graduate Students, 6 First Grade Physics University Students. 14 of the participants were asked to think loud when solving the problems of physics. The written test was used, and the whole process was documented in the report. As per the results of the analysis, the main objective of the inexperienced problem solvers was to solve the problem, while the experienced problem solvers sought to imagine the problem and use the problem-solving techniques.

Heller et al. (2001) examined the beliefs of teaching staff and students in the Physical Departments of Universities on teaching and learning topics. The data obtained through the interviews revealed that the teaching staff felt that some students assumed that problem solving was a linear process, but that problem solving involved self-monitoring and assessment during the process.
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**Sense-making in physics problem solving**

It is evident on the table below that senior high school students’ sense-making on problem solving is generally weighted with 3.81 which indicates that students are somewhat aware on the application of the problem solving in Physics in the real-world scenario.

<table>
<thead>
<tr>
<th>No.</th>
<th>STATEMENTS</th>
<th>Arithmetic Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>When solving physics problems, I often make approximations about the physical world.</td>
<td>3.64</td>
</tr>
<tr>
<td>5</td>
<td>“Problem solving” in physics basically means matching problems with the correct equations and then substituting values to get a number.</td>
<td>4.2</td>
</tr>
<tr>
<td>16</td>
<td>When answering conceptual physics questions, I mostly use my ”gut” feeling rather than using the physics principles I usually think about when solving quantitative problems.</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td><strong>General Weighted Mean</strong></td>
<td><strong>3.81</strong></td>
</tr>
</tbody>
</table>

**Problem solving confidence and sophistication**

The table below shows that senior high school students’ confidence and sophistication on problem solving is generally weighted with 3.74 which indicates that students are somewhat confident and sophisticated in solving physics problems.

<table>
<thead>
<tr>
<th>No.</th>
<th>STATEMENTS</th>
<th>Arithmetic Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If I'm not sure about the right way to start a problem, I'm stuck unless I go see the teacher/TA or someone else for help.</td>
<td>3.88</td>
</tr>
<tr>
<td>3</td>
<td>In solving problems in physics, being able to handle the mathematics is the most important part of the process.</td>
<td>3.96</td>
</tr>
<tr>
<td>6</td>
<td>In solving problems in physics, I can often tell when my work and/or answer is wrong, even without looking at the answer in the back of the book or talking to someone else about it.</td>
<td>3.32</td>
</tr>
<tr>
<td>9</td>
<td>I use a similar approach to solving all problems involving momentum even if the physical situations given in the problems are very different.</td>
<td>3.6</td>
</tr>
<tr>
<td>20</td>
<td>After I solve each physics homework problem, I take the time to reflect and learn from the problem solution.</td>
<td>3.98</td>
</tr>
<tr>
<td>23</td>
<td>If I cannot solve a physics problem in 10 minutes, I give up on that problem.</td>
<td>3.46</td>
</tr>
<tr>
<td>24</td>
<td>When I have difficulty solving a physics homework problem, I like to think through the problem with a peer.</td>
<td>3.84</td>
</tr>
<tr>
<td>25</td>
<td>When I do not get a question correct on a test or homework, I always make sure learn from my mistakes and do not make the same mistakes again.</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td><strong>General Weighted Mean</strong></td>
<td><strong>3.74</strong></td>
</tr>
</tbody>
</table>

Byu and Lee (2014) examined whether students' self-confidence, academic performance and intellectual comprehension varied with an increase in the amount of physical problems resolved. In a study conducted with 49 high school students, the Force Definition Test and Physical Course Performance Grades were used as evaluating instruments and interviews were conducted with 4 selected students. Students have solved an average of 2200 physics problems. The implications of this study showed that the increase in the amount of physics problems solved had little effect on students' academic performance, self-confidence and comprehension of concepts, and that students' ability to solve physical problems could be improved by the techniques learned and applied.

**Conclusion**

Based on the results of the study, the following conclusions were drawn;

1. As reflected on the responses of the students on Attitude and Approaches in Problem Solving, it generally describes that students;
   1.1. Are somewhat aware on the process of problem solving and take control on the process that leads them to enjoyment.
   1.2. Utilize sometimes pictures, illustrations, or scratch works in solving physics problems.
   1.3. Perceive approaches in solving problems
   1.4. Are classified as “novices” as they immediately substitute formula into numbers rather than understand first the given problems.
   1.5. Understand the application of the problem-solving process in real world set-up.
1.6. Are confident enough and sometimes feel sophisticated in solving problems in physics.

**Recommendations**

1. The researchers recommend that teachers of Physics should assess students’ strength and weaknesses in problem solving in physics. This assessment will be used to plan and to implement the appropriate teaching strategy and teach students different approaches.

2. The researchers suggest to the future researchers to study the correlation between the Attitudes and Approaches in solving problems to the Academic Performance of the students.

**References**


A study on the Self-help Groups of Women and its Contribution to their Socio-economic development in Khordha district, Odisha

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10729

Abstract- Women are a vital part of any society. Over the year, there is a gradual realization of the key role of women and her contribution to the family income and employment is increasing as a result of women empowerment in the country. The World Bank (2001) has suggested that empowerment of women should be key aspect of all social development programs. For ages women in rural India have not received much attention and recognition. They were engaged in domestic work and some other supportive work in the family sector. The term “Empowerment” was introduced at Nairobi, Kenya during International Women Conference in 1985. Women empowerment has many dimensions i.e. social empowerment, economic empowerment, cultural empowerment, legal empowerment and political empowerment.

Index Terms- women social empowerment, SHGs, employment generation.

I. INTRODUCTION

Women are a vital part of any society. “There is no chance for the welfare of the world unless the condition of women is improved” - Swami Vivekananda. Women’s development has always been a topic of serious concern in the society and is much debated in recent times. The Constitution of India ensures rights of equality, liberty and dignity to both women and men but in a highly male dominated patriarchal society women are hardly given their share of rights. The Government of India made several efforts for empowerment of women. It introduced the National Policy for Empowerment of Women in 2001 with the goal of empowering women as an agent of socio-economic changes and development. The Department for Women and Child Development was established in the year 1985 as the national machinery for advancement of women and keeping in view the increasing significance of women empowerment and later it was converted into a full-fledged ministry in 2006. Similarly, on the eve of International Women’s day on 8th March 2010 the National Mission of Empowerment of Women was launched by the Government of India for all-round development of women.

The origin of SHGs is the brainchild of Grameen Bank of Bangladesh, which was founded by Prof. Mohammed Yunus. Self-help Groups were formed in 1976. He establish Grameen Bank of Bangladesh in the year 1975, to provide micro-finance to rural women and pioneering the concepts of microcredit and microfinance. These loans are given to entrepreneurs too poor to qualify for traditional bank loans. Prof. Yunus was awarded the Nobel Prize in 2006 for his contribution to development. In India, National Bank for Agricultural and Rural Development (NABARD) initiated the starting of the WSHGs (Women Self-help Groups) in 1986-87. But the real effort was taken after 1991-92 with the linkage of Self-help Groups with the banks. Started with 225 Groups in 1992. IN 1993 Reserve bank of India is also allowed Self-help Groups to open saving accounts in bank facility of availing bank services. According to a report from 2006, NABARD estimates that there are 2.2 million Self-help Groups in India, representing 33 million member, that have taken loans from banks under its linkage program. In Odisha the total number of Self-Help Groups are 4,29,199.

On 8th March 2001 marked the launch of ‘Mission Shakti’, an initiative by the Hon’ble Chief Minister Naveen Patnaik of Odisha to empower women across the state. The Odisha government has cleared a proposal for a separate Mission Shakti department that would exclusively work for around 70 lakh rural women associated with nearly six lakh women self-help groups (WSHGs) created under the Mission Shakti movement and now 6 million of Mission Shakti are working. It is a collective approach to combat rural poverty, unjust social relationship and gender inequality and promote development. Empowering women is not just for meeting their economic needs but also more holistic social development. Therefore the present study “A study on the Self-help Groups of Women and its Contribution to their Socio-economic development in Khordha district, Odisha” is undertaken with this specific objectives.

II. OBJECTIVES

1. To study the Socio-economic profile of SHG members.
2. To study the contribution of SHGs on additional employment generation of members.

III. METHODOLOGY

This chapter is devoted to present the methodological details adopted for fulfilment of the objectives of the study and it
deals with the description of the study area, sampling design of the study and analytical tools employed. Thus, this chapter provide an insight into the conceptual framework for research design. Various phases of methodology used to carry out the present study are discussed under the following broad headings;

3.1. Description of study area
3.2. Sampling design and collection of data

**Description of study area**

Odisha a state on the eastern coast of India, is divided into 30 administrative geographical units called districts. It is the 8th largest state by area, and the 11th largest by population. The state has the third largest population of Scheduled Tribes in India. Khordha district is one of them. Khordha is one of the new districts carved out of the former Puri District on 1st April, 1993. The other new district carved out of Puri was Nayagarh. In the year 2000, the district’s name was changed from Khurda to Khordha. It is the most urbanized of all the districts of Odisha. Khordha is the 6th smallest district in terms of size and 5th biggest in terms of population. The district is divided in to 2 subdivisions, namely Bhubaneswar and Khordha which are further subdivided in to 10 blocks such as Bhubaneswar, Jatni, Balipatna, Baliana, Khordha, Bolagarh, Begunia, Tangi, Banpur and Chilika. The district headquarter is connected to all the block headquarters and important towns by all-weather roads.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total Population</td>
<td>22,511,673</td>
</tr>
<tr>
<td>2</td>
<td>Male Population</td>
<td>11,67,137</td>
</tr>
<tr>
<td>3</td>
<td>Female Population</td>
<td>10,84,536</td>
</tr>
<tr>
<td>4</td>
<td>Child Population (0-6 year age)</td>
<td>2,37,394</td>
</tr>
<tr>
<td>5</td>
<td>Density of Population</td>
<td>800 sq. km</td>
</tr>
<tr>
<td>6</td>
<td>Sex Ratio</td>
<td>929 Females per 1000 Males</td>
</tr>
<tr>
<td>7</td>
<td>Total Number of Household</td>
<td>4,94,212</td>
</tr>
<tr>
<td>8</td>
<td>Number of Rural Household</td>
<td>2,47,304</td>
</tr>
<tr>
<td>9</td>
<td>Number of Urban Household</td>
<td>2,46,908</td>
</tr>
<tr>
<td>10</td>
<td>Main workers</td>
<td>6,32,625</td>
</tr>
<tr>
<td>11</td>
<td>Marginal Workers</td>
<td>1,59,568</td>
</tr>
<tr>
<td>12</td>
<td>Literacy Rate</td>
<td>86.9%</td>
</tr>
<tr>
<td>13</td>
<td>Literacy Rate (Rural)</td>
<td>83%</td>
</tr>
<tr>
<td>14</td>
<td>Literacy Rate (Urban)</td>
<td>91%</td>
</tr>
<tr>
<td>15</td>
<td>Banks</td>
<td>50</td>
</tr>
<tr>
<td>16</td>
<td>Hospital</td>
<td>91</td>
</tr>
<tr>
<td>17</td>
<td>Assembly Constituency</td>
<td>8</td>
</tr>
</tbody>
</table>

**SAMPLING DESIGN AND COLLECTION OF DATA**

The present study is undertaken in the Khordha District Odisha purposively because of the convenience of the researcher for the collection of relevant data. The secondary data regarding the district, number of Self-help Group, effective SHGs. Sourced from the DRDA (District Rural Development Agency) office.

After obtaining the information on the effective self-help groups, 8 effective Self-help Groups were randomly selected from a list of 902 Self-help Groups.

Stratified random sampling were adopted for the selection of Self-help Groups. The primary data were collected by interviewing all the members from the 8 self-help groups. A total number of 80, 10 each respondents from the SHGs. Where
interview as per the prepared schedule. The data was collected by 5 rounds of interview for devoting adequate time each objective.

IV. RESULTS AND DISCUSSION

In this chapter, the field data and secondary data collected from different sources were analysed and results obtained are presented in accordance with the objectives of the study.

4.1 Socio-economic characteristics of respondents

4.1.1 Number of Self-help Groups in Khordha District

<table>
<thead>
<tr>
<th>Area (under ICDS project)</th>
<th>SHGs</th>
<th>Exiting SHG</th>
<th>New SHG</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMC 1</td>
<td>549</td>
<td>882</td>
<td>1,431</td>
<td></td>
</tr>
<tr>
<td>BMC 2</td>
<td>328</td>
<td>490</td>
<td>818</td>
<td></td>
</tr>
<tr>
<td>BMC 3</td>
<td>702</td>
<td>961</td>
<td>1,663</td>
<td></td>
</tr>
<tr>
<td>BBSR (R)</td>
<td>918</td>
<td>958</td>
<td>1,876</td>
<td></td>
</tr>
<tr>
<td>Baliana</td>
<td>1320</td>
<td>826</td>
<td>2,146</td>
<td></td>
</tr>
<tr>
<td>Balipatna</td>
<td>1061</td>
<td>684</td>
<td>1,745</td>
<td></td>
</tr>
<tr>
<td>Jatni</td>
<td>707</td>
<td>1103</td>
<td>1,810</td>
<td></td>
</tr>
<tr>
<td>Khordha</td>
<td>902</td>
<td>1346</td>
<td>2,248</td>
<td></td>
</tr>
<tr>
<td>Begunia</td>
<td>2003</td>
<td>951</td>
<td>2,954</td>
<td></td>
</tr>
<tr>
<td>Bolagard</td>
<td>1059</td>
<td>1084</td>
<td>2,143</td>
<td></td>
</tr>
<tr>
<td>Tangi</td>
<td>1981</td>
<td>831</td>
<td>2,812</td>
<td></td>
</tr>
<tr>
<td>Chilika</td>
<td>1745</td>
<td>865</td>
<td>2,610</td>
<td></td>
</tr>
<tr>
<td>Banapur</td>
<td>798</td>
<td>1278</td>
<td>2,076</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>14,073</strong></td>
<td><strong>12,259</strong></td>
<td><strong>26,332</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: DRDA office
Note: ICDS (Integrated Child Development Services)

The district having 10 blocks with the Bhubaneswar Municipal Corporation (BMC) with a total of 26,332 Self-help Groups. Khordha block accounts for 2,248 Self-Help Groups, out of which 902 are existing SHGs and 1046 are new Self-help Groups. Highest number of SHGs i.e. 2954 exit in Begunia block followed by Tangi and Chilika blocks with 2812 and 2610 respectively.

4.1.2 Profile of selected SHG groups:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Group</th>
<th>Village</th>
<th>No. of members</th>
<th>Age of Group</th>
<th>Year of Establishment</th>
<th>Types of Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Laxmi SHG</td>
<td>Khordha town (Uppersahi)</td>
<td>10</td>
<td>13</td>
<td>2007</td>
<td>Badi &amp; Masala Badi making</td>
</tr>
<tr>
<td>2</td>
<td>Maa Bhagabati SHG</td>
<td>Pubusahi</td>
<td>10</td>
<td>4</td>
<td>2017</td>
<td>Fish cultivation</td>
</tr>
<tr>
<td>3</td>
<td>Gruha laxmi SHG</td>
<td>Diwansahi</td>
<td>10</td>
<td>14</td>
<td>2006</td>
<td>Badi, Pampad, Arisha Pitha making, give training of Tailoring</td>
</tr>
<tr>
<td>4</td>
<td>Padmalaya SHG</td>
<td>Gurujanga</td>
<td>10</td>
<td>2</td>
<td>2019</td>
<td>Pampad, Badi, School Bag</td>
</tr>
</tbody>
</table>
Table 4.1.2 shows the selected eight Self-help Groups for our analysis purpose. These self-help Group are involved in different type of activities like, Badi Making, Masala badi Making, Pampad, Arisha pitha Making, THR Chatua, Nimki Making, School MDM etc. each Self-help group having 10 members.

**Period of Functioning SHG:**

Table 4.1.3: Classification of Self-help Groups as per years of establishment

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than 3 Year</td>
<td>1</td>
<td>12.50</td>
</tr>
<tr>
<td>2</td>
<td>3 Year - 5 Year</td>
<td>2</td>
<td>25.00</td>
</tr>
<tr>
<td>3</td>
<td>5 Year - 10 Year</td>
<td>2</td>
<td>25.00</td>
</tr>
<tr>
<td>4</td>
<td>More than 10 Year</td>
<td>3</td>
<td>37.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8</strong></td>
<td></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Source: Primary data

The above Table shows that on the total 8 Self-help Groups 3 (i.e. 37.5 per cent) is more than 10 years of age, 2 SHGs (i.e 25 per cent) groups is 3-5 year, 2 SHGs (i.e. 25 per cent) group is 5-10 year, 1 SHG (i.e. 12.5 per cent) group is less than 3 year.

**4.1.4 Group Meeting:**

According to guideline of SHG the SHGs should be conduct regular meetings to discuss various issues relating to the group. Economic and social issues like collection and management of credit flow among the members, training problems of SHGs, marketing of the product form part of the agenda of meeting of SHGs.

Table 4.1.4: Classification of SHGs on the basis of Group meetings

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Group Meeting</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Weekly Once</td>
<td>1</td>
<td>12.50</td>
</tr>
<tr>
<td>2</td>
<td>Fortnightly Once</td>
<td>5</td>
<td>62.50</td>
</tr>
<tr>
<td>3</td>
<td>Monthly once</td>
<td>2</td>
<td>25.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8</strong></td>
<td></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Source: Primary data

The data shows 25 per cent of the Self-help Groups convene group meeting monthly once, 62.5 per cent once in a fortnightly and 12.5 per cent weekly once.

**Age of the Respondents:**

Age is the important variable that determines the physical and mental maturity of a person. The age of a person can determine her/ his productivity and working capacity. The age structure of the country also determines its prospect for development.
Table 4.1.5: Age-Wise Classification of the Respondents

<table>
<thead>
<tr>
<th>Age Group</th>
<th>No. of Respondent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 25</td>
<td>2</td>
<td>2.50</td>
</tr>
<tr>
<td>25-45</td>
<td>46</td>
<td>57.50</td>
</tr>
<tr>
<td>45-55</td>
<td>27</td>
<td>33.75</td>
</tr>
<tr>
<td>Above 55</td>
<td>5</td>
<td>6.25</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Field Survey

The age-wise classification of the members is given in the above table 4.1.5 it shows that among the total 80 women participants 2.5 per cent below 25 year of age, 57.5 per cent 25-45 year of age, 33.75 per cent 45-55 of age and 6.25 per cent above 55 years of age. The table indicates out of 80 members 73 (i.e. 91.25 per cent) are in the age of 25-55 that is considered to be effective age group for any decision-making as well as enterprise establishment.

Caste Status:

Caste is an important social variable which determines the social status of an individual in the society of India. It is a form of social stratification based on the idea of purity and population. In the rural areas, the various caste groups are stratified and grouped into various communities for the purpose of receiving the benefits of the welfare programmes of the government.

Table 4.1.6: Caste-wise Classification of Respondents

<table>
<thead>
<tr>
<th>Caste</th>
<th>No. of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC</td>
<td>10</td>
<td>12.50</td>
</tr>
<tr>
<td>ST</td>
<td>9</td>
<td>11.25</td>
</tr>
<tr>
<td>OBC</td>
<td>37</td>
<td>46.25</td>
</tr>
<tr>
<td>General</td>
<td>24</td>
<td>30.00</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Field Survey

The table 4.1.6 shows that SC and ST constitute 23.75 per cent, OBC and general caste constitute 76.25 per cent of the members. This may be due higher concentration of OBC and General caste representing more than 80 per cent of the population.

Educational Status:

Education is significant for the empowerment of women as it affects all the other dimensions of empowerment. Education increases knowledge and patience. The most important benefit of the SHGs is perhaps the opportunity that both illiterate and literate women can participate in the programme.

Table 4.1.7: Education-Wise Classification of Respondents

<table>
<thead>
<tr>
<th>Educational Status</th>
<th>No. of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>34</td>
<td>42.50</td>
</tr>
<tr>
<td>Middle</td>
<td>30</td>
<td>37.50</td>
</tr>
<tr>
<td>Matriculate(10th)</td>
<td>19</td>
<td>23.75</td>
</tr>
<tr>
<td>College</td>
<td>3</td>
<td>3.50</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Field Survey
In the study area none of the members are illiterate this might be due to the selection of Khordha which is an urban area in the district, 42.5 per cent of the total respondents had Primary school education, 37.5 per cent are Middle school education, 23.75 per cent are Matriculate and 3.75 per cent had college education.

Marital Status:
Marriage can be simplify defined as a universal social institution and it marks an important turning point in one’s life. In Indian society, marriage is a religious duty. The following table shows the marital status of SHG members in the study area.

Table 4.1.8: Marital Status of the Respondents

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>No. of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Married</td>
<td>69</td>
<td>86.25</td>
</tr>
<tr>
<td>Widow</td>
<td>9</td>
<td>11.25</td>
</tr>
<tr>
<td>Divorced</td>
<td>2</td>
<td>2.50</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Field Survey

From table 4.1.8 it is evident that 86.25 percent were married, 11.25 percent of the women were widow and only 2.5 percent of the respondents are divorced. The Self-help Group programme play a great role in economic empowerment of these women by providing them opportunity to an additional income and generate assets for the household. The program was also important to the destitute like divorced and widow women among the economically weaker sections who consider themselves as a burden to the family.

Family Type and Size:
Family is a basic social unit and the most significant agent of socialization. The family type and size of the SHG members has been shown in the following table.

Table 4.1.9: Classification of Family Type

<table>
<thead>
<tr>
<th>Family Type</th>
<th>No. of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>63</td>
<td>78.75</td>
</tr>
<tr>
<td>Joint</td>
<td>17</td>
<td>21.25</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Primary Data

Classification of Respondents based on Family Members

<table>
<thead>
<tr>
<th>Family Size</th>
<th>No. of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 4</td>
<td>63</td>
<td>78.75</td>
</tr>
</tbody>
</table>
This indicate the type of the family of Self-help Group members. About 78.75 per cent have nuclear family with a family size less than 4 and 21.25 per cent joint family the size of the family members are more than 4. There is steep emergence of nuclear family and substantial decrease of the age old joint family system in the urbanized Khordha area of Odisha.

**Table 4.1.10: Occupation-Wise Classification of Respondents**

<table>
<thead>
<tr>
<th>Occupational Status</th>
<th>No. of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housewife</td>
<td>48</td>
<td>60.00</td>
</tr>
<tr>
<td>Small Business</td>
<td>16</td>
<td>20.00</td>
</tr>
<tr>
<td>Tailoring</td>
<td>12</td>
<td>15.00</td>
</tr>
<tr>
<td>Govt. job (contractual)</td>
<td>4</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>80</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Source: Field Survey

It is clearly evident from the table 4.1.10 that before joining the SHG most of the members were housewives (60.00 per cent), small business (20.00 per cent), tailoring work (15/00 per cent) and govt. job (5.00 per cent).

**4.2 Contribution of SHG on Additional Employment generation of Women in the Household**

One of the major reasons for poverty in the society is unemployment in rural India, women are engaged in household work and as a result they are able to get enough employment opportunities to sustain better living for the family. It is necessitated for the women in the family to create employment opportunities through group action by forming Self-help Groups for the economic upliftment of themselves as well as their families. Employment provides purchasing power to the person who are employed. If more of the family members are employed more will be the purchasing power of family. In the present study the sample respondents are getting additional employment opportunities by joining different production activities in SHGs and also marketing of products to the customers. Employment generated through group action/ intervention of Self-help Groups is shown in the following table.

**Table 4.2: Contribution of SHG on Employment generation**

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Employment generation</th>
<th>No. of respondents</th>
<th>Percentage</th>
</tr>
</thead>
</table>

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10729
It is clearly evident from the Table 4.2 that 32.50 per cent got employment between 5-10 days, 37.50 per cent got employment between 10-15 days, 21.25 per cent got employment between 15-20 days and 8.75 per cent got employment between above 20 days. It is inferred from the table that majority of the SHG members i.e. 37.50 per cent of the respondents have got additional employment between 10-15 days per month. The additional employment increases the individual’s income as well as family income thereby enhances standard of living of the family.

![Figure 4.2: Employment generation after joining SHGs](image)

V. CONCLUSION

The Self Help Group programme has created tremendous impact on the livelihood of rural women in particular. The present study not only demonstrates positive impact of self help groups on several socio-economic dimensions of rural women, it also strongly endorses the findings of earlier studies. Majority of SHG members were able to get additional employment under different activities by SHG finance. Additional employment also increased their income level. The income level increased significantly after they took part in group activities. The increase in income is also distributed uniformly among all the members. The SHGs also help in improving standard of living thereby making it possible for rural household to spend more in education for children and family health. The study has found that SHGs have served the cause of women empowerment and socio-economic betterment of rural poor women.

REFERENCES


AUTHORS

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Pre-school Teacher Training and Management of Curriculum Implementation: A Case of Navakholo Sub-County, Kenya

Jacob Wambasi Kitari¹ and Lydiah Wamocha²

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Abstract- Pre-school teacher training plays the role of inculcating management skills necessary for managing teaching and learning process in public Early Childhood Development Centres (ECDC). The main objective of this study was to establish the extent to which pre-school teacher training facilitate management of teaching-learning processes in public pre-schools. Pre-school teaching forms the backbone of the academic future for the beginning learners. This is achievable when teachers are adequately trained in curriculum implementation and management. Correlation research design was used to investigate the relationship between pre-school teacher training and management of teaching-learning process. The study targeted 176 teachers in charge and 268 pre-school teachers from 176 public pre-schools. Purposive sampling procedure was used to sample 81 pre-school teachers and 53 teachers in charge. Structured questionnaires were used to collect data from teachers in charge and teachers. According to the findings the certificate level of training produced the most effective teachers 3%47.3%as compared to those with bridging 3%44.9%and diploma 3%40.5%. On the basis of the findings, there is need to intensify pre-school teacher training programmes through inclusion of emerging paradigms like computer application and to review the ECDE teacher training curriculum for diploma course to make it more effective for the teachers to remain relevant on duty performance.

Index Terms- Training level, ECDE Teacher, Teaching/Learning process.

I. INTRODUCTION

Teachers play a crucial role in facilitating the acquisition of learning skills among learners at all levels of Education. At the ECDE level, teachers play the role of laying the foundation for the learners to acquire basic literacy skills thus reading, writing and simple arithmetic. The efficiency of a teacher in facilitating the process of learning is influenced by teacher training amongst other factors. According to Dietrich & Bruder, (2012), there is a positive relationship between pre-school teacher training and management of the teaching-learning process. Despite the training of ECDE teachers, there seem to be a problem in children’s attainment of basic literacy skills thus reading, writing and arithmetic skills. This was established via several studies conducted by Uwezo-Kenya for example in 2010, Uwezo-Kenya, found that the level of literacy acquisition among pre-primary learners is seriously lacking because children completing pre-school level of learning could not read and understand simple English and Kiswahili sentences. They could also not manipulate simple arithmetic operations such as addition and subtraction. However, according to UNESCO, (2010) learners taught by effectively trained pre-school teachers do not exhibit such weaknesses.

These issues raised eyebrows amongst stakeholders in ECDE concerning the relationship between pre-primary teacher training level and the management of curriculum implementation process in public pre-primary schools in Nakakholo Sub-County, Kenya.

II. STATEMENT OF THE PROBLEM

The efficiency of a teacher in facilitating the process of learning is influenced by teacher training amongst other factors. According to Dietrich & Bruder, (2012), there is a positive relationship between pre-school teacher training and management of the teaching-learning process. Despite the training of ECDE teachers, there seem to be a problem in children’s attainment of basic literacy skills thus reading, writing and arithmetic skills. This was established via several studies conducted by Uwezo-Kenya for example in 2010, Uwezo-Kenya, found that the level of literacy acquisition among pre-primary learners is seriously lacking because children completing pre-school level of learning could not read and understand simple English and Kiswahili sentences. They could also not manipulate simple arithmetic operations such as addition and subtraction. However, according to UNESCO, (2010) learners taught by effectively trained pre-school teachers do not exhibit such weaknesses.

These issues raised eyebrows amongst stakeholders in ECDE concerning the relationship between pre-primary teacher training level and the management of curriculum implementation process in public pre-primary schools in Nakakholo Sub-County, Kenya.

III. LITERATURE REVIEW

Teacher training programme has been defined by Fisher and Waideen, (1990) as a set of phenomena deliberately intended to prepare the teacher to deliver knowledge, skills, dispositions and norms required by the syllabus. The phenomena include lectures, seminars, field trips, practice of various kinds, models on specific topics, micro-teaching, observation in schools, tutoring individual trainees, peer-tutoring, examinations, screening procedures, social events among other aspects as provided by the curriculum of the programme (Dietrich & Bruder, 2012).

Furthermore, Pre-school teacher training should be able to improve teachers’ communication skills, professional attitudes, values and also equip the teacher with knowledge and the ability to identify and develop the education needs of the learners (Dietrich & Bruder, 2012). This explains why governments across the world have Pre-school teacher training programmes. In line with this, the Government of Kenya regards “Academically and professionally qualified pre-school teachers as a prerequisite for provision of high quality and relevant education at all levels”
The 2010 constitution of the Republic of Kenya chapter thirteen, Cap 237, has a provision for the Teachers Service Commission (T.S.C) to review the standards of education and training of persons entering the teaching service emphasising the legal framework as regards pre-school teacher training programme. However, in spite of several reviews, it remains unclear why pre-school teachers are not yet meeting the expectations as regards teachers’ service delivery; hence, the need for this study to evaluate the current pre-school teacher training levels in relation to the ability to manage ECDE Curriculum especially in public pre-primary Schools in Kenya. Providing consistent training across teacher education programmes is particularly challenging in the field Early Childhood Education due to lack of cohesive early childhood system in most countries (Winton, 2010). Although specific nations may have early childhood education programmes with particular training requirements for the teachers need, there is no internationally enforced standard for early childhood teacher education (Winton, 2010). This explains the diversity of, early childhood teacher training programmes. In Kenya, they include bridging, certificate and diploma courses offered through Sub-county Centres for Early Childhood Education (SCCECE) colleges.

Though Pre-school teacher training services have been offered in Kenya for long, the impact on service delivery especially in terms of the teachers’ capacity to equip learners with reading, writing and arithmetic skills as well as its influence on management of syllabus implementation is far from perfection (Uwezo-Kenya, 2010). It is against this background that this study was developed to investigate how pre-school teacher training in Kenya impacts on the management of syllabus implementation.

Gardner (2003) noted that teachers are expected to perform syllabus implementation functions. However, according to a study by Taylor and Miels, (2012), early childhood teachers report management of syllabus implementation challenge as a predominant reason for stress and burnout among both teachers and learners. This explains the need for effective training and support in the management of ECDE syllabus implementation process. In particular, more attention needs to be paid to the type of training provided to the early childhood teachers (Dietrich & Bruder, 2012). This qualifies the necessity of this study to identify training needs that are relevant to syllabus implementation in the Kenyan perspective. In order to guide the management of syllabus implementation effectively; pre-school teacher training programmes should include personnel preparation strategies that are based on appropriate professional standards. The standards include benchmarks for training in syllabus implementation management skills, learning assessment and other essential interventions like discipline management.

Syllabus implementation management skills should be focussed on proper understanding of the educational goals, aims and objectives (Taylor & Miels, 2012). All interventions should address the understanding of teacher-learner relationships and supportive interactions as a foundation of pre-school teaching (Dietrich & Bruder, 2012). The differences experienced in syllabus implementation process by pre-school teachers who have varying training levels, makes it necessary to ascertain the depth of training content offered at specific training level. This explains why this study was undertaken to assess the extent to which Kenyan ECDE teacher training facilitate syllabus implementation process.

IV. RESEARCH METHODOLOGY

Research Design

In this study, correlation research design was adopted. This was because according to Mugenda and Mugenda, (2010) correlation research facilitates collection of data from an accessible population in order to determine the current status and relationship between the issues under investigation. In this case, the correlation facilitated collection of data related to the influence of teacher training on management of ECDE Curriculum implementation process. Correlation design was considered appropriate for this study because according to Kasomo, (2007), Mugenda and Mugenda, (2010) and Rubin et al., (2010), it ensures fair relationship of all sections of the target population.

Sample Size

According to Mugenda and Mugenda (2010 & 2003) a large number of respondents is expected to yield a more reliable research findings because they indicate that correlation studies require a large sample of respondents in order to give reliable results. On the basis of this argument this research study used a sample size of 434 respondents distributed as indicated in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Sample Size Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
</tr>
<tr>
<td>Teachers</td>
</tr>
<tr>
<td>Headteachers</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

Research Instruments: Structured Questionnaires

Two different structured questionnaires were used to collect primary data. The first one gathered data from ECD teachers in charge and a second one from the pre-school teachers. They were considered appropriate for data collection because according to Njenga and Kabiru (2009) and Kothari, (2010) they facilitate
controlled data collection since each item had predetermined multiple choices for the respondents to select from. This was further supported by the fact that according to Mugenda and Mugenda, (2010), the items in structured questionnaires are easy to analyze due to the presence of the multiple choices. During data collection each respondent was given a questionnaire to complete and return within a period of one week. Questionnaires return rate of 100% was achieved. A questionnaire for the teacher in charge had two sections. The first section captured background information about pre-school teacher training level, while, the second section had seven items that sought to correlate teacher training level and syllabus implementation aspects. A questionnaire for the pre-school teacher covered background information concerning the characteristics of the level of pre-school teacher training and the second part had questions on management of instructional materials and the delivery of basic literacy skills.

Research Results and Discussion

Distribution of Respondents

The distribution of teachers in terms of training levels was 26 at bridging course 33 certificate and diploma 20.

A sub group of 53 teachers in charge were targeted. The distribution of the ECD teachers in charge was 5 males and 48 females. In terms of training 9, 23 and 21 of the teachers in charge had bridging, certificate and diploma levels of training respectively. The distribution of respondents is shown in figure 1.

![Figure 1: Teacher Training Levels](image)

Table 2: Teachers Current Professional Qualification

<table>
<thead>
<tr>
<th>Bridging</th>
<th>Certificate</th>
<th>Diploma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>Teacher</td>
<td>Teacher</td>
</tr>
<tr>
<td>s</td>
<td>s</td>
<td>s</td>
</tr>
<tr>
<td>in charge</td>
<td>in charge</td>
<td>in charge</td>
</tr>
<tr>
<td>26</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>23</td>
<td>20</td>
<td>19</td>
</tr>
</tbody>
</table>

The study findings revealed that there were 26 ECDE teachers with a bridging course, 33 had long course certificate and 20 teachers had attained diploma levels of training. The bridging course was meant to help teachers who had lower grade academically to secure an opportunity to serve the public as teachers in the beginner classes. Majority of the pre-primary teachers 33 started teaching with certificate level of training while those with diploma who are perceived to have acquired the highest level of training within the researcher’s area of jurisdiction were very few thus 20. Teachers in charge were also asked to state their level of training at the time they started teaching in their respective stations. The results revealed that 13 of them started the teaching career with a grade of short course.

Teachers in charge who joined their career of imparting knowledge, skills and attitudes into the learners with a professional development level of certificate were the majority represented by 76. Last but not least only 15 teachers in charge were privileged to start the teaching fraternity with a higher level of training thus diploma in early childhood development and education. This group of managers are expected to perform slightly better than those with the lower cadre of training.

Management of ECD Syllabus Implementation Process

All over the world, Syllabus implementation is perceived as a critical factor in effective teaching/learning services (Alvarez,
in 2007). In fact, it is one of the challenges that affect the delivery of quality teaching services in most public ECDE centres in Kenya. It is against this background that this study was formulated to assess the relationship of Pre-school teacher training and management of syllabus implementation process. The study specifically covered the bridging course, certificate course and diploma training levels which was implemented in form of two years in-service programme. This focus was informed by the fact that most of the serving ECDE teachers had attained these levels of training. The pre-school teachers in charge being the officially designated managers of the curriculum implementation process as per the existing policy guidelines were the school personnel accessible to information regarding pre-school teacher training and management of ECDE syllabus implementation process, hence, the suitable sources of information with regard to this specific objective of the study.

The findings of the study were as indicated in Table 3.

Table 3: Pre-school Teacher Training levels and Management of curriculum Implementation

<table>
<thead>
<tr>
<th>Syllabus implementation Aspect</th>
<th>Bridging</th>
<th>Certificate</th>
<th>Diploma</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery of Arithmetic skills</td>
<td>43.4</td>
<td>50</td>
<td>51</td>
<td>47.3</td>
</tr>
<tr>
<td>Curriculum interpretation Accuracy</td>
<td>39.10</td>
<td>50</td>
<td>44.4</td>
<td>44.9</td>
</tr>
<tr>
<td>Delivery of reading skills</td>
<td>47.8</td>
<td>46.5</td>
<td>25</td>
<td>40.5</td>
</tr>
<tr>
<td>Improvement of reading skills</td>
<td>47.8</td>
<td>33.4</td>
<td>25</td>
<td>36.1</td>
</tr>
<tr>
<td>Delivery of writing skills</td>
<td>47.8</td>
<td>31.3</td>
<td>25</td>
<td>34.7</td>
</tr>
<tr>
<td>Improvement of writing skills</td>
<td>26</td>
<td>45</td>
<td>27.8</td>
<td>32.6</td>
</tr>
<tr>
<td>Efficiency of curriculum implementation</td>
<td>26</td>
<td>30</td>
<td>33.3</td>
<td>29.4</td>
</tr>
<tr>
<td>Average</td>
<td><strong>40.4</strong></td>
<td><strong>47.3</strong></td>
<td><strong>33</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: (Field Data, 2014)

Analysis of the results revealed that certificate level of teacher training had the highest mean score amongst the seven aspects of syllabus implementation aspects covered in the study as indicated by a mean score of 47.3%. The results showed that certificate level of pre-school training was more suitable than the other levels of training. It was followed by bridging course with a mean score of 40.4% while diploma training had the lowest mean score of 33%. The gap between scores attained by teachers who had the bridging and certificate levels (47.3% >40.4%) was attributed to the idea that pre-school teacher training at certificate level is more enriched in terms of the necessary knowledge and skills, hence, more effective in curriculum implementation than that for bridging level of training which is also an academically lower level. This was in line with the findings of Kodak, (2011) according to whom higher training levels are more suitable than lower levels. The Certificate level of training also scored higher than diploma training level. This might have been due to the differences in the relevance of the syllabi of certificate and diploma teacher training programmes with the certificate syllabus being more appropriate and effective. This is contrary to the report of Godia, (2005) according to which advancement in teacher training levels are expected to directly correlate with increase in appropriateness and effectiveness in duty performance.

Further analysis of the results indicated that teacher training levels exhibited different degrees in regard to ECDE syllabus coverage. Delivery of arithmetic skills was the most significant aspect as justified by the respondents’ mean score of 47.3%. It was equally noticed in both certificate and diploma levels of training 50%. The set level of significance was at alpha 0.05 whereby in case the coefficient score is more, the null hypothesis will be rejected and if it is less, the null hypothesis will not be rejected. From the above analysis the researcher rejected the null hypothesis which states that there is no statistically significant relationship between various levels of ECD teacher training syllabi. However, comparatively bridging teacher training had a lower mean 43.4%. This was attributed to the idea that the teacher training syllabus at this stage was relatively inferior and ineffective relative to delivery of arithmetic skills to the ECDE learners.

Accuracy of curriculum interpretation was the second variable in regard to syllabus coverage with a mean score of 44.9%. The gap (47.3% >44.9%) in the mean scores on delivery of arithmetic skills and the accuracy of curriculum interpretation was attributed to the skewness of the teachers training programmes towards instilling basic arithmetic skills at the expense of the accuracy of curriculum interpretation and implementation in all teaching subject areas.

Certificate teacher training had the highest mean on accuracy of curriculum interpretation 50% followed by diploma 44.4% and then bridging level came third with a mean score of 40.5%. The results indicated that the syllabus for certificate level of training pre-school teachers was more suitable for the ECDE syllabus implementation relative to interpretation and by
extension service delivery followed by that of Diploma and then bridging level.

Alternatively, the bridging course syllabus lacked the capacity to facilitate interpretation of the ECDE syllabus while that of diploma level of training was too advanced relative to the ECDE syllabus demands and learning needs of ECDE children. The level of performance by the diploma trained teachers could also be because the syllabus is more inclined towards management than practical teaching that calls for accurate syllabus interpretation. Similar findings were established by Merrel, (2010), who observed that as teachers advance in professional development, they relax and reduce their output.

Another aspect of syllabus implementation was delivery of reading skills with a mean score of 40.5%. The gap (44.9% > 40.5%) between accuracy in curriculum interpretation and delivery of reading skills was attributed to the fact that teacher’s capacity to impart reading skills to the learners was founded on accuracy of curriculum interpretation. This is in accordance with Godia, (2005) according to whom the capacity of the teacher to interpret the syllabus was both a pre-cursor and determinant of the capacity to deliver reading skills hence the lower score on delivery of reading skills.

Further analysis of the results revealed that teacher training levels enhances delivery of reading skills. From the analysis scores from different levels of training decreased with advancement in training levels. This was justified by mean scores of 47.8%, 46.5% and 25% for bridging course, certificate, and diploma levels respectively. This was attributed to the fact that the syllabi for higher levels of pre-school teacher training tended to exclude or significantly minimized the coverage of the fundamentals of reading skills which are critical literacy requirements for the ECDE learners (Fox et al., 2010). The results further indicated that the exclusion increased more significantly between certificate and diploma levels. This was duly justified by the wideness of the gap between the respective mean score levels (46.5% > 25%). This finding is in line with the report of the MOEST, (2006) which recommended scaling up or upward review of teacher training syllabi to enhance teacher preparedness for better competencies at the work place.

Comparatively, analysis of the results showed that preschool teacher training on improvement of the learner’s reading skills was lower than that of the delivery of reading skills (36.1% <40.1%). This indicated that though it is easy for teachers to deliver basic reading skills for simple reading exercises, improving the capacity of the learners for more complex reading demands is still a challenge to the ECDE teacher training interventions. This was attributed to limitations in content and focus of all levels of ECDE teacher training (Pribble, 2013). A deeper analysis of the results further revealed that teacher training interventions decreased as one advances up the teacher training levels as indicated by mean scores of 47.8%,33.4% and 25% for bridging course, certificate and diploma levels respectively. This is contrary to MOE report of 2005 according to which advancement in training should lead to progressive improvement in service delivery. These results could also be accounted for by the fact that advancement in training levels was accompanied with reorientation towards management concerns at the expense of curriculum implementation inclusive of improvement of learners’ reading skills.

There was also a significant relationship between delivery of writing skills and syllabus intervention with a mean score of 35.4%. The narrow gap (36.1% > 35.4%) between the two syllabus aspects was attributed to the fact that the basic academic demands for improvement of reading skills and delivery of writing skills were similar. Further analysis of the results indicated that teacher training on delivery of writing skills decreased as one advanced from bridging through certificate to diploma training levels as indicated by mean scores of 47.8%, 31.3% and 25% respectively. This was attributed to the fact that higher teacher training levels excluded topics on the fundamentals of writing or only had limited content.

The next aspect of teacher training that followed was that on teachers’ capacity to improve the children’s writing skills which had a mean score of 32.6%. However, the trend of relationship between teacher training and improvement of writing skills was unique when compared to other study aspects. This was because the scores increased significantly as one advanced from bridging to certificate level (26%<45%) and dropped significantly from certificate to diploma levels (45%>27.8%). The trend indicated certificate level of training to be the optimum level for improvement of the ECDE learners’ writing skills. The lower score realized by the bridging when compared to that of certificate level of teacher training was attributed to the idea that the content and design of the syllabus for bridging course was too basic to facilitate advancement of these skills at the same time the diploma syllabus was not adding value for the same practice. Similar results were established by Brown (2008) who observes that authorities should always strive to select suitable content and syllabus for training purposes.

Among the aspects of syllabus interpretation and implementation covered in the study, efficiency of curriculum implementation had the least mean by teachers’ training level with a score of 29.4%. This indicated that all ECDE teachers’ training interventions had serious weaknesses since efficiency in the implementation of the ECDE curriculum is the basic indicator of the adequacy of the content for teachers’ training. A deeper analysis of the results indicated that though below average, the scores of teacher training levels increased as one shifts from bridging through certificate to diploma levels (25% <30% <33.3%). This trend was attributed to the idea that the teachers’ training helps teacher trainees to perfect their management skills which are more suitable relative to syllabus interpretation as one advance in professional development. These results are in tandem with the findings of Godia, (2005) according to whom advancement in training levels progressively translates into better service delivery.

**Hypothesis Testing**

When the results of this objective were subjected to hypothesis testing using Pearson’s moment correlation coefficient, the findings were as in table 4.
When the findings of this research study were subjected to one way analysis of variance (ANOVA) to evaluate the relationship between Pre-school Teacher Training levels and Management of Syllabus Implementation in Nakakholo sub-county, the results were $F(2,53) = 4.13, P = 0.04.

According to the findings, the relationship between teacher training levels and management of curriculum implementation has a correlation coefficient of 0.04 (Pearson’s product moment correlation coefficient score). In this study the set alpha level for rejection of null hypothesis was 0.05. From the assessment of the coefficient score the researcher rejected the null hypothesis which states that there is no significant relationship between teacher training levels and management of ECDE syllabus implementation. This rejection indicates that pre-school teacher training levels are statistically significant in relation to management of syllabus implementation.

### V. CONCLUSION AND RECOMMENDATION

**Conclusion**

The study examined the correlation between pre-school teacher training and the application of management skills in public pre-primary centres. What emerged was that Certificate level of teacher training had better knowledge of ECDE curriculum interpretation and implementation with a mean of 47.3%. The bridging course had a lesser mean of 40.4% while the diploma level had the least average score of 33%. It revealed that certificate level of training enhanced a high level of interactive teaching with the learners which proved more effective compared to other levels of training. The diploma level of training produced the least effective ECDE teachers in terms of curriculum implementation.

**Recommendation**

On the basis of the findings of the study, there is need to review the quality of training for diploma ECDE teachers in order to manage emerging dynamics in the management of pre-school teaching/learning process.

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Analysis Of Community Satisfaction Index On Pt Adaro Indonesia's 5 CSR Programs In 2019

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Abstract- CSI (COMMUNITY SATISFACTION INDEX) measurement is one of the instruments that measuring level of service performance in the community. This instrument provides an opportunity for the community to be involved in the assessment of Performance FiveField from PT Adaro Indonesia's CSR objectively periodically as the basis for further planning. The purpose of this study is to analyze the community satisfaction index (CSI) in the CSR program of PT Adaro Indonesia in 2019. This type of research is survey through a cross-sectional approach. The population in this study was drawn from the beneficiaries of PT Adaro Indonesia's CSR program in 2019. The sample is the beneficiaries of PT Adaro Indonesia's CSR program which is consist of 5 fields, 26 clusters / programs, 907 respondents. CSI in 5 field of CSR, namely economy, education, health, socio-culture and the environment with the category satisfied (82.5), CSI the economic sector with the category satisfied (82.5), education with the category satisfied (83.84), the health sector with the category satisfied (79.4) socio-cultural field by category very satisfied (90.6), the environmental field with the category satisfied (81.9), there is an increase in CSI 5 in PT Adaro's CSR sector compared to 2014, 2018 and 2019. Suggestion, companies can maintain and improve the CSI so that will be better in the following year by increasing socialization and dissemination of information on CSR programs in the community.

Index Terms- CSI, CSR, Adaro Indonesia

I. INTRODUCTION

Adaro Indonesia, which is one of the coal companies in South Kalimantan, PT Adaro Indonesia as a leading coal mining company always complies with government policies. This includes the obligation to implement CSR programs in operational villages. The CSR program is not only carried out by Adaro, but also by its partners. The company synergizes with the government to contribute to human development since the company operates. PT Adaro Indonesia's CSR program is divided into 5 programs, namely economy, education, health, socio-culture and environment with the main target in the villages in the company's operational areas, 2 Provinces, 6 Districts, 15 Districts and 65 Villages according to the needs of the surrounding communities who are affected or have the opportunity to feel impact of industrial processes. The five pillars aim at creating an independent post-mining community in the sense of economic independence, intellectual independence and management independence with a value system of honesty, justice, simplicity, equality and non-discrimination based on the principles of participation, democracy, transparency, accountability and partnership.

CSR is not only a company's creative activity and is not limited to compliance with legal regulations alone, but is a company's commitment to building a better quality of life with related stakeholders (government and society), especially the community around the company. Because the role of CSR is currently increasingly important for the community around the company in an effort to balance development, be it economic, social, cultural health and the environment.

PT Adaro Indonesia's CSR activities are also the implementation of Law No. 40 of 2007 which regulates Limited Liability Company CSR, namely that the company established has a certain activity sector that emphasizes the aspects of community welfare. Activities in the course of its implementation, CSR has been widely accepted by the community in the company's operational villages and has had a positive impact, so that the community can benefit from the existence of the company in its area.

CSI measurement is one of the instruments used to analyze service performance in the community. This instrument provides an opportunity for the public to be involved in periodically assessing the Five Pillars Performance of PT Adaro Indonesia's CSR as a basis for further planning. A satisfied community is a very valuable asset because if the community is satisfied, it will continue to empower the company and will form a good perception to others about their good experiences (7). The scope of measurement for CSI is guided by the Regulation of Permenpan 14 of 2017 concerning Guidelines for Preparing Community Satisfaction Surveys. The previous regulations were deemed non-operational and required technical elaboration in their implementation. So it needs...
to be adjusted to an applicable survey method and easy to implement. In addition, this Regulation is intended to provide clear and firm directions and guidelines for service providers. The elements will be the focus in implementing the Community Satisfaction Survey which consists of 9 elements consisting of requirements; systems, mechanisms and procedures; turnarounds time; fees / rates; product type service specification; executive competence; implementing behavior; the handling of complaints; as well as facilities and infrastructure.

Measurement of the Community Satisfaction Index (CSI) is also useful for companies to support the preparation of future community development and empowerment plans, in accordance with the Minister of Energy and Mineral Resources Decree Number: 1824 / K / 30 MEM / 2018 concerning Guidelines for Implementation of Community Development and Empowerment (PPM), in addition to The CSI is also one of the items that must be in place for the fulfillment of the PROPER parameters of the Ministry of Environment and Forestry (KLHK) in accordance with the Minister of Environment and Forestry Regulation Number: 3/2013 and for the fulfillment of CSR Key Performance Indicators (KPIs) in making analytical bases for decision making with focus on things that are considered the most important and can be measured.

The area for measuring the Community Satisfaction Index (CSI) is carried out in the village of PT Adaro Indonesia's operational area, namely in 6 districts, 15 districts and 28 CSR programs for measuring the Community Satisfaction Index, these are the company's operational village communities who have received benefits from the company's CSR program in 2018, namely beneficiaries of the five pillars, namely economic, education, health, socio-cultural and environmental programs.

II. RESEARCH METHOD

This research is analytic observational. The population in this study was drawn from the beneficiaries of the CSR program. The instrument or tool used in this research is a public perception questionnaire based on the Community Satisfaction Index (CSI) according to the Decree of the Minister of State Apparatus Empowerment No. KEP / 25 / M.PAN / 2 / 2004 concerning General Guidelines for Preparation of Community Satisfaction Index

III. RESULTS AND DISCUSSION

Table 1 Results of 5 Sector SMIs

<table>
<thead>
<tr>
<th>No.</th>
<th>Field</th>
<th>Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Economy</td>
<td>82.50</td>
<td>Satisfied</td>
</tr>
<tr>
<td>2</td>
<td>Education</td>
<td>83.84</td>
<td>Satisfied</td>
</tr>
<tr>
<td>3</td>
<td>Health</td>
<td>79.49</td>
<td>Satisfied</td>
</tr>
<tr>
<td>4</td>
<td>Socio-cultural</td>
<td>90.66</td>
<td>Very satisfied</td>
</tr>
<tr>
<td>5</td>
<td>Environment</td>
<td>81.90</td>
<td>Satisfied</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>82.55</td>
<td>Satisfied</td>
</tr>
</tbody>
</table>

Source: CSI Survey of ADARO CSR Program 2019

Achievements of the CSI Program in the Economy

CSI in the economic sector has a score 82.50 with the category very satisfied. Where there are 8 programs that are measured, namely the village development program, UMKM, agriculture, plantations, fisheries, livestock, village echoes, and economic infrastructure. The following is a comparison between the CSI in the economic sector in 2018 and 2019:

Table 2 Comparison between the CSI in the Economic Sector in 2018 and 2019

<table>
<thead>
<tr>
<th>Field / Program</th>
<th>CSI (2018)</th>
<th>CSI (2019)</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village</td>
<td>80</td>
<td>83.19</td>
<td>+3.19</td>
</tr>
<tr>
<td>Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UMKM</td>
<td>77.5</td>
<td>83.96</td>
<td>+6.46</td>
</tr>
<tr>
<td>Agriculture</td>
<td>80</td>
<td>85.49</td>
<td>+5.49</td>
</tr>
<tr>
<td>Plantation</td>
<td>87.5</td>
<td>80.92</td>
<td>-6.58</td>
</tr>
<tr>
<td>Fishery</td>
<td>77.5</td>
<td>77.99</td>
<td>0.49</td>
</tr>
<tr>
<td>Ranch</td>
<td>80</td>
<td>79.06</td>
<td>-0.94</td>
</tr>
<tr>
<td>Echo Village</td>
<td>77.5</td>
<td>76.75</td>
<td>-0.75</td>
</tr>
<tr>
<td>Economic</td>
<td>82.5</td>
<td>77.17</td>
<td>-5.33</td>
</tr>
<tr>
<td>Infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: CSI Survey of ADARO CSR Program 2019

From Table 2, it can be seen that the total value of CSI in the Economic Sector in 2019 has increased 2.5 compared to 2018. The Community Development Program, UMKM and Agriculture made a positive contribution to the increase in the achievements of CSI in the Economic Sector in 2019.

Achievements of the CSI Program in the Field of Education

CSI in education has a score 83.84 with the category very satisfied. Where there are 4 programs that are measured, namely the BUD IPB program, BUD UPN, regular scholarships, and educational infrastructure. The following is a comparison between the CSI in the education sector in 2018 and 2019:

Table 3. Comparison between the SME Education Sector in 2018 and 2019

<table>
<thead>
<tr>
<th>Field / Program</th>
<th>CSI (2018)</th>
<th>CSI (2019)</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUD IPB</td>
<td>82.5</td>
<td>87.41</td>
<td>+4.91</td>
</tr>
<tr>
<td>UPN BUD</td>
<td>75</td>
<td>82.60</td>
<td>+7.60</td>
</tr>
<tr>
<td>Regular</td>
<td>77.5</td>
<td>85.42</td>
<td>+7.92</td>
</tr>
<tr>
<td>Scholarship</td>
<td>80</td>
<td>79.10</td>
<td>-0.90</td>
</tr>
<tr>
<td>Educational</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: CSI Survey of ADARO CSR Program 2019
From Table 3, it can be seen that the CSI value in the education sector in 2019 has increased in achievement by 3.84 compared to the achievements in 2018. The BUD IPB program, BUD UPN and regular scholarships have contributed significantly to the improvement of the achievements of CSI in the education sector.

Achievements of the CSI Program in the Health Sector

The health sector CSI has a score 79.49 with the category very satisfied. Where there are 6 programs that are measured, namely the KIBBLA program, cataract surgery, clean water, social health services, healthy schools, health infrastructure. The following is a comparison between the CSI in the health sector in 2018 and 2019:

<table>
<thead>
<tr>
<th>Field / Program</th>
<th>CSI (2018)</th>
<th>CSI (2019)</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>KIBBLA</td>
<td>80</td>
<td>76.86</td>
<td>- 3.14</td>
</tr>
<tr>
<td>Cataract Surgery</td>
<td>82.5</td>
<td>79.81</td>
<td>- 2.69</td>
</tr>
<tr>
<td>Clean water</td>
<td>70</td>
<td>78.92</td>
<td>+ 8.92</td>
</tr>
<tr>
<td>Health Service</td>
<td>80</td>
<td>79.54</td>
<td>- 0.46</td>
</tr>
<tr>
<td>Healthy School</td>
<td>80</td>
<td>81.00</td>
<td>+ 1.00</td>
</tr>
<tr>
<td>Health Infrastructure</td>
<td>75</td>
<td>80.61</td>
<td>+ 5.61</td>
</tr>
<tr>
<td>Health</td>
<td>77.5</td>
<td>79.49</td>
<td>+ 1.99</td>
</tr>
</tbody>
</table>

Source: CSI Survey of ADARO CSR Program 2019

From Table 4, it can be seen that the CSI in the socio-cultural sector in 2019 experienced a significant increase, namely by 10.66% compared to the achievement in 2018. The Religious and Sports Program provided a significant contribution to increasing the achievements of CSI in the socio-cultural field.

Environmental Sector CSI Achievements

Environmental CSI has a score 81.90 by category satisfied. Where there are 4 programs that are measured, namely reuse, reduce, recycle (3R), environmental education, Adiwiyata schools, and environmental infrastructure. The following is a comparison between CSI in the socio-cultural field in 2018 and 2019:

<table>
<thead>
<tr>
<th>Field / Program</th>
<th>CSI (2018)</th>
<th>CSI (2019)</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>3R</td>
<td>82.5</td>
<td>82.63</td>
<td>0.13</td>
</tr>
<tr>
<td>Environmental Education</td>
<td>77.5</td>
<td>83.48</td>
<td>+ 5.98</td>
</tr>
<tr>
<td>Adiwiyata School</td>
<td>82.81</td>
<td>83.90</td>
<td>+ 12.91</td>
</tr>
<tr>
<td>Environmental Infrastructure</td>
<td>78.79</td>
<td>82.9</td>
<td>+ 7.70</td>
</tr>
<tr>
<td>Socio-cultural</td>
<td>80</td>
<td>90.66</td>
<td>+ 10.66</td>
</tr>
</tbody>
</table>

Source: CSI Survey of ADARO CSR Program 2019

From Table 5, it can be seen that the value of CSI in the socio-cultural sector in 2019 experienced a significant increase, namely by 10.66% compared to the achievement in 2018. The Religious and Sports Program provided a significant contribution to increasing the achievements of CSI in the socio-cultural field.
IV. CONCLUSION

1. CSI the economic sector with the category satisfied (82.50)
2. CSI the field of education with the category satisfied (83.84)
3. CSI health sector with the category satisfied (79.49)
4. CSI in the socio-cultural field by category very satisfied (90.66)
5. Environmental CSI with the category satisfied (81.90)
6. CSI in 5 areas of CSR, namely economy, education, health, socio-culture and the environment with the category satisfied (82.55)
7. CSI 5 in the CSR Sector of PT. Adaro was categorized as quite satisfied in 2014, so there was an increase in 2018 to the satisfied category. There was an increase in the indicators of satisfaction, namely the attributes of funding, behavior of implementers and handling of complaints, suggestions and input and infrastructure. Community Satisfaction Index Value in 5 CSR Areas of PT. Adaro in 2019 when compared to the previous year was still in the satisfied category, but in terms of value increased by 0.1.

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AUTHORS

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Analysis of Performance and Satisfaction with The 5 Fields of Pt Adaro Indonesia CSR Program In 2019

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Abstract- Performance refers to a result of human resource activities that exist in the organization together to bring the final result based on the quality level and predetermined standards. The purpose of this study was to analyze the relationship between performance and satisfaction of the beneficiaries of the 5 CSR areas of PT. Adaro Indonesia in 2019. This type of research is analytic observational using a survey method through a cross-sectional approach, in which data concerning the independent and dependent variables can be collected at one time. The population in this study was drawn from the beneficiaries of PT Adaro Indonesia’s CSR program in 2019. The sample is the beneficiaries of PT Adaro Indonesia's CSR program which is divided into 5 fields, consisting of 26 clusters / programs, 907 respondents. Based on analysis of the relationship between performance and interest shows that the funding indicator and officer behavior is something that must be maintained in the implementation of programs carried out by the CSR of PT. Adaro Indonesia. Suggestion, companies need to pay more attention to indicators that lie in secondary priority and tertiary priority even though in fact they have been implemented well by the company.

Index Terms- Performance, Satisfaction, CSR, Adaro Indonesia

I. INTRODUCTION

The importance of providing good and satisfying public services is a major concern in today's era. Public service performance is one of the strategic dimensions in assessing the success of implementing public services. The higher the concern of an organization / agency / company in meeting the interests of the community, the better the performance of public services (Sutrisno and Mariyono, 2016). Performance appraisal is very important for a company. With this performance appraisal, a company can see the extent to which human factors can support the goals of a company organization. Performance appraisals can motivate employees to be motivated to work better. Therefore we need a proper and consistent performance appraisal. The quality of a company organization through CSR in the field of public services comes from human resources who are one of the keys to success in advancing a company. The success and performance of a person in a field of work is largely determined by the level of competence, integrity, professionalism and work ethic of the officers. In addition, existing human resources can create and develop a conducive climate and work culture. Performance appraisal is very important for an organization. With this performance appraisal an organization can see the extent to which human factors can support the goals of an organization. Performance appraisals can motivate employees to be motivated to work better. Therefore, we need a proper and consistent performance appraisal.

The success of a company is greatly influenced by the performance of its employees. Performance is work performance, namely the comparison between real work results and the work standards set (Dessler, 1992). Every organization strives to improve the performance of its employees in order to achieve the goals set by the organization. Various ways can be taken by organizations in improving employee performance, including realizing employee job satisfaction through organizational culture and leadership styles that are in accordance with the expectations of employees and society.

In general, what is meant by satisfaction is the feeling of pleasure or disappointment of someone who comes after comparing product performance with the desired results (Kotler, 2005). If the quality of service exceeds expectations, the customer / consumer will feel very satisfied. The opinion above concluded that satisfaction is the level of a person's feelings after comparing the perceived performance with expectations.
PT Adaro Indonesia, which is one of the coal companies in South Kalimantan. PT Adaro Indonesia as a leading coal mining company always complies with government policies. This includes the obligation to implement CSR programs in operational villages. The CSR program is not only carried out by Adaro, but also by its partners. The company synergizes with the government to contribute to human development since the company operates.

PT Adaro Indonesia's CSR program is divided into 5 programs, namely economy, education, health, socio-culture and environment with the main target in the villages in the company's operational areas, 2 Provinces, 6 Districts, 15 Districts and 65 Villages according to the needs of the surrounding communities who are affected or have the opportunity to feel impact of industrial processes. The five pillars aim at creating an independent post-mining community in the sense of economic independence, intellectual independence and management independence with a value system of honesty, justice, simplicity, equality and non-discrimination based on the principles of participation, democracy, transparency, accountability and partnership.

CSR is not only a company's creative activity and is not limited to compliance with legal regulations alone, but is a company's commitment to building a better quality of life with related stakeholders (government and society), especially the community around the company. Because the role of CSR is currently increasingly important for the community around the company in an effort to balance development, be it economic, social, cultural health and the environment.

Measurement of IKM is one of the instruments used to measure the level of service performance in the community based on the Regulation of the Minister of Administrative Reform and Bureaucratic Reform of the Republic of Indonesia Number 14 of 2017 concerning Guidelines for Preparing Community Satisfaction Surveys. This instrument provides an opportunity for the public to be involved in periodically assessing the Five Pillars Performance of PT Adaro Indonesia's CSR as a basis for further planning. A satisfied community is a very valuable asset because if the community is satisfied, it will continue to empower the company and will form a good perception to others about their good experiences (Pohan, 2007).

The elements will be the focus in implementing the Community Satisfaction Survey which consists of 9 elements consisting of requirements; systems, mechanisms and procedures; turnaround time; fees / rates; product type service specification; executive competence; implementing behavior; the handling of complaints; as well as facilities and infrastructure.

Measurement of the Community Satisfaction Index (IKM) is also useful for companies to support the preparation of future community development and empowerment plans, in accordance with the Minister of Energy and Mineral Resources Decree Number: 1824 / K / 30 MEM / 2018 concerning Guidelines for Implementation of Community Development and Empowerment (PPM), in addition to The IKM is also one of the items that must be in place for the fulfillment of the PROPER parameters of the Ministry of Environment and Forestry (KLHK) in accordance with the Minister of Environment and Forestry Regulation Number: 3/2013 and for the fulfillment of CSR Key Performance Indicators (KPIs) in making analytical bases for decision making with focus on things that are considered the most important and can be measured.

II. METHODS

This research is analytic observational using a survey method through a cross-sectional approach, in which data concerning independent and dependent variables can be collected at one time. The population in this study was drawn from the beneficiaries of the CSR program. The instrument or tool used in this research is a public perception questionnaire based on the Community Satisfaction Index (CSI) according to the Decree of the Minister of State Apparatus Empowerment No. KEP / 25 / M.PAN / 2/2004 concerning General Guidelines for Preparation of Community Satisfaction Index.

The analytical tool used to analyze the level of community satisfaction in implementing CSR is Importance Performance Analysis (IPA), which consists of three components, namely gap analysis, suitability analysis, and quadrant analysis. Gap analysis is used to determine the gap between performance / implementation with the expectations / interests of the community towards the attributes of the service quality dimensions of CSR programs. The suitability analysis is used to determine the priority order of the attributes that are priority improvements based on the percentage comparison between the performance value and the importance level of the CSR program service quality dimension attributes. Quadrant analysis is used to determine the community's response to the attributes mapped based on the level of importance and performance of the attributes of the service quality dimensions of CSR programs.
III. RESULTS AND DISCUSSION

The calculation of the average weight of each attribute regarding the level of importance (importance) and user ratings of service performance (performance) can be seen in Table 1 below:

Table 1. Analysis of the Relationship between Interests and Performance

<table>
<thead>
<tr>
<th>No.</th>
<th>Scope</th>
<th>Interest Score</th>
<th>Category</th>
<th>Performance Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Terms of Service</td>
<td>3.36</td>
<td>Urgent</td>
<td>3.23</td>
<td>Satisfied</td>
</tr>
<tr>
<td>2</td>
<td>Systems, mechanisms, procedures</td>
<td>3.32</td>
<td>Urgent</td>
<td>3.22</td>
<td>Satisfied</td>
</tr>
<tr>
<td>3</td>
<td>Service turnaround time</td>
<td>3.32</td>
<td>Urgent</td>
<td>3.22</td>
<td>Satisfied</td>
</tr>
<tr>
<td>4</td>
<td>Funding</td>
<td>3.41</td>
<td>Urgent</td>
<td>2.25</td>
<td>Satisfied</td>
</tr>
<tr>
<td>5</td>
<td>Products / service results</td>
<td>3.33</td>
<td>Urgent</td>
<td>3.25</td>
<td>Satisfied</td>
</tr>
<tr>
<td>6</td>
<td>Implementing competence</td>
<td>3.33</td>
<td>Urgent</td>
<td>3.25</td>
<td>Satisfied</td>
</tr>
<tr>
<td>7</td>
<td>Implementing behavior</td>
<td>3.38</td>
<td>Urgent</td>
<td>3.31</td>
<td>Satisfied</td>
</tr>
<tr>
<td>8</td>
<td>The handling of complaints</td>
<td>3.34</td>
<td>Urgent</td>
<td>3.24</td>
<td>Satisfied</td>
</tr>
<tr>
<td>9</td>
<td>Facilities and infrastructure</td>
<td>3.32</td>
<td>Urgent</td>
<td>3.20</td>
<td>Satisfied</td>
</tr>
</tbody>
</table>

Source: IKM Survey of ADARO CSR Program 2019

Based on the table above, further analysis is needed to determine the priority scale in an effort to improve each of the existing attributes. The next step is mapping the importance and performance levels into a Cartesian Importance-Performance Analysis diagram. In this technique, respondents are asked to assess the level of importance and performance of the company, then the average value of the importance and performance level is analyzed on the Importance Performance Matrix, where the x-axis represents performance while the y-axis represents the importance of the results, a matrix consisting of four is formed. quadrant where each quadrant describes the priority scale in policy making in the form of improving performance or maintaining company performance (Laricha et al, 2018).

Table 2. Categories Importance Performance Matrix

<table>
<thead>
<tr>
<th>Scope</th>
<th>Quadrant</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terms of Service</td>
<td>IV</td>
<td>Tertiary Priority</td>
</tr>
<tr>
<td>Systems, mechanisms, procedures</td>
<td>III</td>
<td>Secondary Priority</td>
</tr>
<tr>
<td>Service turnaround time</td>
<td>III</td>
<td>Secondary Priority</td>
</tr>
<tr>
<td>Funding</td>
<td>I</td>
<td>Maintain Achievement</td>
</tr>
<tr>
<td>Products / service results</td>
<td>III</td>
<td>Secondary Priority</td>
</tr>
<tr>
<td>Implementing competence</td>
<td>IV</td>
<td>Tertiary Priority</td>
</tr>
<tr>
<td>Implementing behavior</td>
<td>I</td>
<td>Maintain Achievement</td>
</tr>
<tr>
<td>Handling complaints, suggestions and input</td>
<td>IV</td>
<td>Tertiary Priority</td>
</tr>
<tr>
<td>Facilities and infrastructure</td>
<td>II</td>
<td>Main priority</td>
</tr>
</tbody>
</table>

Source: IKM Survey of ADARO CSR Program 2019

Analysis using Importance Performance Matrix is performed to determine the position of each attribute that has been assigned to the two-dimensional plane (X-axis and Y-axis) on the Cartesian diagram. The positions of these attributes will show four things related to the importance level and performance level of each of the previously defined attributes. This analysis can be used to determine the priority scale in efforts to improve each of the existing attributes. The next step is mapping the importance and performance levels into a Cartesian Importance-Performance Analysis diagram. In this technique, respondents are asked to assess the level of importance and performance of the company, then the average value of the importance and performance level is analyzed on the Importance Performance Matrix, where the x-axis represents performance while the y-axis represents the importance of the results, a matrix consisting of four is formed. quadrant where each quadrant describes the priority scale in policy making in the form of improving performance or maintaining company performance (Laricha et al, 2018).
as a strategic step in an effort to increase community satisfaction and determine the priority of activities that need to be carried out or perhaps activities that are not necessary. Based on Figure 1 it explains:

1. Quadrant I (Maintain Achievement) shows that funding and staff behavior are perceived most important and satisfying to the community that has been implemented well by the company. The factors / attributes that exist in this quadrant must be maintained because these factors make the company superior according to the beneficiary community program CSR.

2. Quadrant II (Main Priority) indicates that facilities and infrastructure are considered important by the community and have been implemented well by the company.

3. Quadrant III (Secondary Priority) indicates that the system, mechanism, procedure and time of completion of services as well as product attributes / service outcomes are not really urgent (secondary) for the beneficiary community CSR program, but in fact it has been implemented well by the company.

4. Quadrant IV (Tertiary Priority) shows that the service requirements, the competence of executors and the attributes for handling complaints, suggestions and input are not important (tertiary), but in fact the company has performed well and is very concerned about these indicators.

IV. CONCLUSION

1. Analysis of the relationship between performance and interests shows that the community considers that the funding indicator is something that must be maintained by CSR of PT. Adaro Indonesia.

2. Analysis of the relationship between performance and interests shows that the community considers that indicators facilities and infrastructure are considered important by the community and have been implemented properly by the company.

3. Analysis of the relationship between performance and interests shows that society considers that something that doesn't really matter for indicators systems, mechanisms, procedures and time for completion of services as well as product attributes / service outcomes, but have been implemented properly by the company.

4. Analysis of the relationship between performance and interests shows that the community considers that indicators Service requirements, executive competence and complaint handling, suggestions and input are not important, but have been implemented properly by the company.

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Relationship between compliance to Iron and Folic Acid Supplementation and Anaemia among Pregnant Women in Nyeri County, Kenya

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Abstract: Folate deficiency has been associated with abnormalities in both mothers and fetuses. This study therefore sought to determine the prevalence of non-compliance with IFAS among pregnant women and to determine if IFAS non-compliance influences anaemia in Nyeri County, Kenya. This was a mixed methods study. Pregnant women attending antenatal care in level 4 and level 5 facilities were targeted. A sample of 385 respondents was calculated using modified formulae by Fisher. Questionnaires were used to collect information from the expectant mothers. The mean age was 31 years. The mean income was KES 50,912. Majority (56%) of respondents lived in rural areas. Majority (55%) of the respondents in the study indicated that they had at one time forgotten to take their IFAS supplements. Majority (55%) of the participants had hemoglobin levels of between 121 g/l and 150 g/l while 37% of the participants had hemoglobin levels of below 120 g/l. Chi-square tests showed a significant relationship (p=0.018) between compliance to IFAS and prevalence of Anemia. The study concluded that increasing prevalence of anemia among pregnant women can be attributed to the high prevalence of non-compliance among pregnant women in Nyeri County. Pregnant women should therefore be sensitized on the importance of complying with iron and folic acid supplements.

Keywords: Iron, Folic acid, IFA, Pregnant women, Anemia

INTRODUCTION

When a woman is pregnant, it marks an important stage in her life and those close to her; this affects her directly and indirectly. An increase in iron and folic acid occurs due to hormonal and physiological changes in her body (Siabani et al., 2018). Iron and folic acid dietary sources should be provided through diet to meet the daily-recommended dietary allowances in pregnancy, which in some cases are usually insufficient from dietary sources (Bothwell, 2000) therefore women in developing Countries must be supplemented with iron and folic acid as a preventive strategy of anaemia during pregnancy (Dinga, 2013). Subsequently, the body losses are unregulated. Dietary sources must contain foods of high biological value and must be taken with others that boost absorption as the body itself works on releasing iron from recycling hepatocytes and macrophages (Dev & Babitt, 2017). Iron deficiency is the most widespread common nutrition disorder globally affecting more than 30% of the World’s population more so women and children (Miller, 2013). World Health Organization notes that 46.3% of the African region and globally 38.2% of pregnant women has anemia. Pregnant women are at risk of iron and folic acid deficiency due to an increase in nutrient demands as a result of the developing fetus and increasing blood volume (WHO, 2008).

Demands for folate increase during pregnancy because it is also required for growth and development of the fetus. Folate deficiency has been associated with abnormalities in both mothers (anemia, peripheral neuropathy) and fetuses (congenital abnormalities) (Greenberg, Bell, Guan & Yu 2011). There are drugs that inhibit absorption of folic acid or inhibit conversion of folate to its active form resulting to folic acid deficiency (Khan & Jialal, 2018). Compliance to Iron and folic acid supplementation is affected by a few factors that include poor compliance to the drug regimens, gastro intestinal side effects, frequency of side effects, fear of having big
babies, insufficient service delivery, personal problems (Ibrahim et al., 2011), stock outs of drugs in the health facilities, in adequacy of counseling by health care workers on the use and the benefits of the supplements, low uptake of health care services, lack of information on the iron and folic acid supplements, inconsistence on anemia knowledge, but research recommends that 1000 micro grams of iron is necessary for mother and fetus during pregnancy (Dinga, 2013).

Indirectly anemia is the main cause of high maternal and neonatal deaths, It is worth noting that When the anemia prevalence in pregnant women is 40.0% or more, it is considered a severe public health problem (Okube, Mirie, Odhiambo, Sabina & Habtu, 2015). Therefore, The Government of Kenya has come up with strategies to deal with anemia which include supplementation of Iron and Folic acid, implementation of Focused Antenatal care even though there have been challenges which have resulted in sub optimal coverage and low rates of compliance (MOH, 2013). Iron and folic acid supplements are provided free of charge in government health facilities. However, the major problem is noncompliance to the supplements which now affects effectiveness in fighting iron deficiency anemia this could be due to culture issues, environmental factors, lack of awareness, personal behaviors, side effects, inadequate service delivery and social demographic status (Mithra et al., 2013).

Iron deficiency anemia is a risk factor for maternal and perinatal mortality and morbidity and was projected to have contributed to 115,000 of the 510,000 Maternal deaths (22%) and 591,000 of the 2,464,000 perinatal deaths (24%) occurring annually around the world (WHO, 2011a). The incidence of maternal mortality resulting from anemia is 34/100 000 live births (Helmy et al., 2018). The World Health Organization estimates that 41.8% of women who are pregnant globally are anemic. In Kenya, anemia prevalence is estimated to be at 55.1% accounting to about 10% maternal and 20% perinatal deaths (Kamau et al., 2018), 46.4% of non-pregnant women are anemic. According to KNBS and ICF Macro 2010, In Central Kenya where Nyeri County lies 56.3% of pregnant women take Iron supplements for less than 60 days, 2.6% take for 60-89 days while as 28.5% do not take iron tablets during pregnancy. Data on non-compliance of iron and folic acid in Nyeri County is scarce and a study on determinants of non-compliance to iron folic acid supplementation during pregnancy was needed. This study therefore Sought to determine the prevalence of non-compliance with IFAS among pregnant women and to determine if IFAS non-compliance influences anaemia in Nyeri county, Kenya.

METHODOLOGY

This was a mixed methods study. The study was conducted in Nyeri County one of the 47 counties in Kenya. Pregnant women attending antenatal care in level 4 and level 5 facilities were targeted. The study targeted this population of the expectant women aged 18-49 years of age coming for antenatal services in the level 4 and level 5 public health facilities in Nyeri County. The information was collected in the maternal child health clinic. A sample of 385 respondents was calculated using modified formulae by Fisher as shown below.

\[ n = \frac{z^2p(1-p)}{e^2} \]

\( z = \) is the Z value for the corresponding confidence level (i.e., 1.96 for 95% confidence);

\( e = \) is the margin of error (i.e., 0.05 = ± 5%) and

\( p = \) is the estimated value for the proportion of a sample that have the condition of interest.

\[ P= 30\% \text{ (the most conservative estimate)} = 0.34 \text{ (Miller, 2013).} \]

Therefore 
\[ n = \frac{1.96 \times 1.96 \times 0.34 \times (1-0.3)}{0.05 \times 0.05} = 385 \]
The study employed the use of a structured researcher administered questionnaire. Questionnaires were used to collect information form the expectant mothers. Descriptive statistics were used to analyze the quantitative data which was presented in form of frequency and percentage tables, bar graphs and pie charts. Chi-square tests were conducted to determine association of IFAS non-compliance on anemia. The data was analyzed using SPSS. Tables were used to present findings.

RESULTS

Socio-Demographic Characteristics of Respondents

A total of 385 expectant women aged 18-49 years of age coming for antenatal services in the level 4 facilities and in level 5 facility in Nyeri County participated in the study. This means that the study achieved a maximum (100%) response rate. Results showed that 44% of the respondents were aged between 25 and 31 years while those aged between 32 and 38 years accounted for 30% of the respondents. The mean age was 31 years. The findings show that 47% of the respondents had acquired secondary education. Majority (66%) of the participants in the study were married and 47% of the respondents had acquired secondary education. Results showed that 34% were self-employed, 18% were unemployed and 11% were housewives. The average monthly income for 25% of the participants earned between KES 10,001 and KES 25,000 while 21% earned below KES 10,000. The mean income was KES 50,912. Majority (69%) of the respondents had between 1 and 3 children. The average parity was 1 child. Majority (56%) of the respondents were expecting their second child. Majority (64%) of respondents also lived in rural areas.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Category</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>&lt;24</td>
<td>50 (13)</td>
</tr>
<tr>
<td></td>
<td>25-31</td>
<td>169 (44)</td>
</tr>
<tr>
<td></td>
<td>32-38</td>
<td>116 (30)</td>
</tr>
<tr>
<td></td>
<td>39-45</td>
<td>39 (10)</td>
</tr>
<tr>
<td></td>
<td>&gt;46</td>
<td>11 (3)</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>254 (66)</td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>131 (34)</td>
</tr>
<tr>
<td>Education</td>
<td>Primary</td>
<td>150 (39)</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>181 (47)</td>
</tr>
<tr>
<td></td>
<td>College</td>
<td>46 (12)</td>
</tr>
<tr>
<td></td>
<td>University</td>
<td>8 (2)</td>
</tr>
<tr>
<td>Income (KES)</td>
<td>&lt;10,000</td>
<td>81 (21)</td>
</tr>
<tr>
<td></td>
<td>10,001 - 25,000</td>
<td>95 (25)</td>
</tr>
<tr>
<td></td>
<td>25,001 - 50,000</td>
<td>43 (11)</td>
</tr>
<tr>
<td></td>
<td>50,001 - 75,000</td>
<td>49 (13)</td>
</tr>
<tr>
<td></td>
<td>75,001 - 100,000</td>
<td>36 (9)</td>
</tr>
<tr>
<td></td>
<td>&gt;100,001</td>
<td>81 (21)</td>
</tr>
<tr>
<td>Parity</td>
<td>None</td>
<td>89 (23)</td>
</tr>
<tr>
<td></td>
<td>1-3</td>
<td>266 (69)</td>
</tr>
<tr>
<td></td>
<td>4-6</td>
<td>30 (8)</td>
</tr>
<tr>
<td>Residence</td>
<td>Urban</td>
<td>139 (36)</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>246 (64)</td>
</tr>
</tbody>
</table>

Prevalence of IFAS Non-Compliance

Majority (56%) of the respondents in the study indicated that they had at one time forgotten to take their IFAS supplements. In the previous one week prior to the study, 33% had forgotten to take their IFAS supplements. This shows that non-compliance to IFAS was high among the respondents. This is consistent with findings of Ibrahim et al. (2011), Taye et al. (2015) and Gebreamlak et al. (2017) who in studies conducted in Egypt, Amhara, Ethiopia and Addis Ababa, Ethiopia respectively found that compliance of prenatal iron and folic acid supplementation remained low in the areas that the study was conducted.
Table 2 Prevalence of IFAS Non-Compliance

<table>
<thead>
<tr>
<th></th>
<th>Yes n(%)</th>
<th>No n(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forgot to take IFA supplements</td>
<td>216(56)</td>
<td>169(44)</td>
</tr>
<tr>
<td>Forgot to take IFA supplements in previous 1 week</td>
<td>127 (33)</td>
<td>258(67)</td>
</tr>
</tbody>
</table>

Results in Table 3 show that among those who had at one time forgotten to take their IFAS supplements, 44% forgot due to being busy at work, 28% because of side effects and 26% simply forgot.

Table 3 Reason behind forgetting to take Supplements

<table>
<thead>
<tr>
<th>Reason</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simply forgot</td>
<td>56 (26)</td>
</tr>
<tr>
<td>Side effects</td>
<td>60 (28)</td>
</tr>
<tr>
<td>Work commitments</td>
<td>95 (44)</td>
</tr>
<tr>
<td>Forgot to carry</td>
<td>39 (18)</td>
</tr>
<tr>
<td>Lost them</td>
<td>19 (9)</td>
</tr>
<tr>
<td>Others</td>
<td>6 (3)</td>
</tr>
</tbody>
</table>

Prevalence of Anemia

Majority (55%) of the participants had haemoglobin levels of between 121 g/l and 150 g/l while 37% of the participants had haemoglobin levels of below 120 g/l. The mean haemoglobin level was 126 g/l. The results therefore show that majority of participants had acceptable levels of haemoglobin (121 g/l and 150 g/l).

Table 4 Hemoglobin Levels among Pregnant Women

<table>
<thead>
<tr>
<th>Hemoglobin Level (g/l)</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;120</td>
<td>142 (37)</td>
</tr>
<tr>
<td>121-150</td>
<td>212 (55)</td>
</tr>
<tr>
<td>&gt;151</td>
<td>31 (8)</td>
</tr>
<tr>
<td>Total</td>
<td>385 (100)</td>
</tr>
</tbody>
</table>

Relationship between IFAS Non-Compliance and Prevalence of Anemia

Forgetting to take supplements in one week was compared to haemoglobin levels. Chi-square tests showed a significant relationship (p=0.018) between compliance to IFAS and prevalence of Anaemia.

Table 5 Chi-Square output between IFAS Non-Compliance and Prevalence of Anaemia

<table>
<thead>
<tr>
<th></th>
<th>Chi-square (χ²)</th>
<th>Degree of freedom (df)</th>
<th>(P-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residence * IFAS Compliance</td>
<td>1.203</td>
<td>1</td>
<td>0.273</td>
</tr>
<tr>
<td>IFAS Compliance * Anemia</td>
<td>10.118</td>
<td>3</td>
<td>0.018</td>
</tr>
<tr>
<td>IFAS compliance * Child Mortality</td>
<td>0.265</td>
<td>1</td>
<td>0.606</td>
</tr>
</tbody>
</table>

DISCUSSION

This study sought to determine the prevalence of non-compliance with IFAS among pregnant women and to determine if IFAS non-compliance influences anemia. Majority (56%) of the respondents in the study indicated that they had at one time forgotten to take their IFAS supplements. In the previous one week prior to the study, 33% had forgotten to take their IFAS supplements. Majority...
(55%) of the participants had hemoglobin levels of between 121 g/l and 150 g/l while 37% of the participants had hemoglobin levels of below 120 g/l. The mean hemoglobin level was 126 g/l. Chi-square tests showed a significant relationship (p=0.018) between compliance to IFAS and prevalence of Anemia. This implies that compliance to IFAS may reduce the prevalence of Anemia among pregnant women. Iron and folic acid are essential micronutrients for proper physiological activity, growth and survival. Like so many other nutrients, during pregnancy their demand increases and a supplement is needed to meet the daily needs of pregnancy. Increased demand for iron and folates due to physiological and hormonal changes in pregnant women and fetal consumption contribute to increased chances of deficiency of iron and folate. Therefore, Iron and Folic acid are better given to pregnant women in supplements to raise hemoglobin concentration with the goal of decreasing anaemia levels to the maximum degree possible at the end of the day. To this end, several developed nations and developing countries like Kenya have adopted systems of iron supplementation. Consequently, IFAS compliance during pregnancy is seen as a key factor in iron deficiency anaemia prevention and regulation. This is consistent with findings of Sing et al. (2014), Taye et al. (2015) and Niguse and Murugan (2018) in studies conducted in Nepal and Ethiopia who found that iron supplements compliance is an important factor in prevention and treatment of iron deficiency anaemia.

CONCLUSION

The study concludes that the prevalence of non-compliance among pregnant women in Nyeri County was high. Majority of respondents had missed taking their tablets. This is a concern as IFAS supplementation is only effective when adhered to religiously. In addition, increasing prevalence of anaemia among pregnant women can be attributed to the high prevalence of non-compliance among pregnant women in Nyeri County. Pregnant women should therefore be sensitized on the importance of complying with iron and folic acid supplements. The women can be trained on setting reminders and having someone such as spouse remind them of taking the supplements to reduce forgetfulness. Health workers and especially nurses working in health facilities in the MCH should be given refresher courses to enhance their counselling skills. This will enable them counsel women better on the need and importance of complying with IFAS. IFAS supplements should be given to pregnant women at the MCH and not at the pharmacy to reduce waiting time.

REFERENCES


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Assessing The Extent of Land Use/Land Cover Change of Guga Forest Reserve, Giwa - Kaduna (1986-2019)

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Abstract- The relevance of forests to the environment and mankind cannot be overemphasized, as it is often referred to as an important component of the ecosystem at all levels which provides a wide range of services and functions such as; regulating water supplies, buffering floods and droughts, mitigating the adverse effects of Green House Gases (GHG) emission and harboring biodiversity. The aim of this research was to determine the extent of landuse/landcover change of Guga Forest Reserve in, Shika, Giwa Local Government Area of Kaduna State, Nigeria. The methodology adopted for this research includes using Remote Sensing and Geographic Information (GIS) techniques, Landsat MSS imagery of 1986, Landsat TM imagery of 1990, Landsat ETM+ data of 1999 and Landsat 8 OLI image 2019. The datasets were processed and classified into land use/land cover classes using the supervised classification technique in Erdas imagine 9.2 environment and ArGIS 10.1. The result revealed that the result generated from 1986 LandSat MSS (Fig. 1) indicates that agricultural land occupied the highest proportion of the total land accounting for more than half of the entire area (51.4%), followed closely by bare land (29.2%) while forest, built-up and water body amounted to 13.9%, 4.7% and 0.8% respectively. The analysis further generated from Landsat 8 OLI (Fig. 4) revealed that agricultural land and built-up increased dramatically by 72.4% and 5.8% respectively. Forest, bare land and water body decreased to 9.9%, 11.8% and 0.1%. This implies that agricultural land and built-up is fast encroaching into the forest land. The research concludes that there is high rate of urban encroachment in the Guga forest reserve area. There is also serious encroachment of physical development and cultivation on the forest cover, these could be attributed to unplanned urban growth and inadequate monitoring of the forest reserve. The study recommends that Proactive measure should be taken by all stakeholders in Giwa Local government area and Kaduna State towards a better understanding of the changing pattern of land-use and land-cover types of the area to be better equipped in order to manage various environmental challenges that might be associated with such changes.

Index Terms- Land Use; Land Cover; Change; Environment; Encroachment

I. INTRODUCTION

Urban concept varies from country to country and with periodic recategorization, can also vary within one country over time, making direct comparisons difficult. An urban area can be defined by an administrative criteria and political boundaries within the jurisdiction of a municipality or town committee. A threshold population size where the minimum for an urban settlement is 2,000 in habitat and this figure varies between 2000 and 50,000 people or where a significant majority of the population engaged in non-agricultural activities (Brenna, 1990; Abubakar, 2012; Danburi, 2014). Urban growth refers to the relative or absolute increase in the number of people who live in towns and cities (Mathew, 2010; Akingbogun, et. al., 2012; Albert, et. al., 2016). The pace of urban population growth depends on the natural increase of the urban population and the population gained by urban areas through both net rural-urban migration and the recategorization of rural settlements into cities and towns (Cohen, 2005). However, majority of the world’s population today lives in urban areas thereby causing an unprecedented expansion of urban areas (United Nations, 2009; Cohen, 2016). Based on the United Nation’s report in 2008, more than 50 percent of the world population presently lives in cities of varying sizes and this will continue to increase particularly in developing regions of the world (Adesina, 2005; Daramola and Iben, 2010; United Nations, 2009; Danburi, 2014).

Globally, the towns and cities of developing countries are growing rapidly in both population and areal coverage, due to great waves of distress migration from rural areas. Thus, the urban centre in developing countries are expected to double their total population from 2 billion in 2000 to 4 billion by the year 2030, and triple their total built-up areas from about 200,000 square kilometres to more than 600,000 square kilometres within this same period, given an annual average density decrease of 1.7% to constitute 54.5% of the total urban built-up areas in the world by 2030 (Adesina, 2005; Shlomo, Stephen and Daniel, 2005; Cohen, 2016).

Expanding population has brought with them a range of problems for both the physical and built environment. As our big cities have grown away from the centre to accommodate people's settlement needs, suburbs have mushroomed outwards, producing what is referred to as 'urban sprawl” (Danburi, 2014; Balogun, et. al., 2017). This process means that the natural environment suffers...
as more space is required for the construction of houses, roads, the development of industry among other. As more ecosystems are disrupted and habitats are destroyed, urban growth leads to an even greater reduction and distortion of biodiversity of proximal area (Skwirk, 2014; Danburi, 2014).

In the loss of biodiversity according to World Fact Book (2012), Nigeria was identified as one of the countries with the highest rate of forest loss (3.3 percent) in the world. Since 1990, the country has lost 6.1 million hectares or 35.7 percent of its forest covers. It also recorded that Nigerian most biodiversity ecosystem is fast depleting at an unbelievable rate. For example, between 1990 and 2005, Nigeria lost an average of 409,700 hectares of forest every year equal to an average deforestation rate of 2.38 percent. As of 2005, Nigeria has the highest rate of deforestation in the world according to Food Agriculture Organization of the United Nations (FAO, 2010a; FAO, 2010b). The significant effect of loss of forest/vegetation is the exposure of bare surfaces to disaster such as erosion, pollution and consequently climatic change with an adverse effect on both physical and human environment (Sheyin, 2004; Jaieoba and Essoka, 2016).

However, the situation in Guga Forest Reserve, like any other forest globally, is of both economic and environmental consequences. However, due to rapid urban growth, coupled with poor monitoring strategy, this forest reserve is now threatened greatly which could be devastating if it is not properly managed. Human activities are recognized worldwide as the major cause of deforestation, with the agricultural and urban-industrial activity complex which is considered as important factors (Geist and Lambin, 2003; Vince and Iovanna, 2006; Abubakar, 2012; Danburi, 2014; Mathew, 2016). Hence the need to assess the effect of urban growth within the area especially as it affects the forest land.

Application of Remote Sensing and GIS in Forest Studies

Ati, Abbas, Sheyin and Mohammed (2010) used Remote Sensing and GIS in assessing changes in Kagoro Forest in Southern part of Kaduna State. The results of the analysis revealed that settlement and cultivated area increased between 1987 and 2005 by 72% and 17.77% respectively while undisturbed forest decreased by 24.06% within these same periods. The results show a significant depletion of the forest because of human activities particularly cultivation for agricultural purposes.

Abubakar, 2012 and Danburi, 2014 reviewed forest cover change in Jorhat Golaghat District of Assam using Remote sensing and GIS. They carried out a comparative study using topsoheets of 1974 and IRS 1D LISS-3 bands 2, 3 and 4, imagery of 2005. The reserve forest areas were mapped from the satellite imagery using the visual interpretation techniques. The imagery was visually interpreted using six basic photo elements viz. tone, texture, shape, size, pattern and association together with numerous ground truth observations. With these assemblages of photo elements showed against each terrain unit, boundaries of distinct reserve forest were demarcated. The results showed substantial decrease in the Reserve Forest Area. Dayang Reserve forest is totally vanished by encroachment, same was the condition of Nambar, Holongpar and Disai Valley Reserve Forest where the crown coverage is less than 40 percent of the total Reserve Forest Area. The analysis reveals that the total reserves forest area decreased tremendously from 458.8 sq km in 1974 to 176.68 sq km in 2005.

Daniel and Ayobami (2007) assessed changes in land use cover in some part of southwestern Nigeria over 16 years. Satellite imagebs of 1986 and 2002 were used. The result showed that the disturbed/degraded forest constitute the most extensive type of land use land cover in the study area. The increasing population and economic activities were noted to be putting pressure on the available land resources. It was also discovered that 98.3% and 63.7% of the area covered with high forest in Ikeji forest reserve and Akure forest reserve respectively were converted to shrub lands / farm lands over the period of 16 years.

Jibril (2009) assessed changes in vegetation cover in Kpashimi forest reserve in Niger state Nigeria. Landsat TM, ETM plus, SPOT and Nigeria- Sat I of 1987, 1994, 2004 and 2007 were used. The images were classified using Maximum Likelihood classification algorithm by the extraction of Normalized Differential Vegetation Index based on supervised classification. Post classification method was applied. Arc GIS 9.2 and Erdas Imagine 8.3 image processing software were used in calculation the landscape indices and the quantification of landscape transformation processes. The spatial pattern change revealed that the landscape structure of the forest reserve has change tremendously due to shrinking in the proportion of the savannah woodland and Riparian forest (Jimoh, 2011; Daniel and Ayobami, 2017).

II. THE STUDY AREA AND RESEARCH METHODOLOGY

Location

Historical Development: The history of Shika can be traced to the historic development of makayo village. The emergence of shika no doubt, came in as a result of the expansion and growth of makayo village which was as far back as 1907. This expansion was mainly due to the establishment of some Institutions and Industries such as, the National Animal Research Institute (NAPRI), Ahmadu Bello University Teaching Hospital (ABUTH), Champion Soap Factory, Shika Ranch, Shika Grains Processing Center among others. The relocation of ABUTH to its present permanent site in the year 2005 saw a rapid development of Shika and its environs. Shika no doubt, came into being due to the influx of workers from various areas to the institution (ABUTH). Thus, most of the workers coming from afar settled at Shika town. Hence, the need for accommodation was inevitable. Therefore, this experience brought about rapid increase in human population (Abubakar, 2012; Danburi, 2014). Guga Forest Reserve is situated 12.9 kilometer (8 miles) west of Samaru along Zaria Funtua road in Giwa Local Government Area of Kaduna State, with an aerial extent of 4634 hectares. It is located on the plain of the northern part of Kaduna State. The forest reserve lies between Latitudes 11°10’00 N and 11°16’14 N of the equator and Longitudes 7°30’ 34” E and 7°37’ 06” E of the Greenwich meridian. It has a total land area of about 2,066 square kilometers. It is bounded to the north by Funtua, east by Sabon gari, Zaria and...
Kudan, in the south; it is bounded by Igabi local government area as shown in Fig. 1 and 2.
Source: KADGIS, Kaduna State, 2020

**Land Use/Land Cover Change of The Area for The Period 1986-2019**

The Land use/land cover change of the area was determined through broadly classifying the images into five different categories/polygons viz: built-up, forest land, water bodies, agricultural land and bare land. After the image classification, the histogram (image statistics) of the area coverage (extent) of each land use land cover theme for each period of study were used to determine the land use land cover change by comparing the statistics of the recent image with that of the previous date (Abubakar, 2012; Agam, 2014; Danburi, 2014). The change in square kilometers of a land use/land cover type was derived by subtracting the previous area coverage (km²) from the recent. Change in square kilometers = the previous area coverage of land use/land cover type of interest minus the recent (for instance, the area coverage of built-up in 1986 minus the area coverage of built-up in 1990). To get the percentage change of each land use/land cover type, this formula was used:

\[
\text{Observed Changes KM}^2 \times 100% \\
\text{Percentage change of class} = \frac{\text{Base-year}}{\text{Recent-year}}
\]

### III. CHARACTERIZATION OF LAND-USE/LAND-COVER OF THE AREA

The land-use/land-cover classes of Guga Forest in 1986, 1990, 1999 and 2019 were characterized into five prominent classes which include: Built-up, Agricultural land, Forest land, Bare land and Water bodies as shown in Fig. 3, 4, 5, 6 and Table 1 below.

![Image of Land Use/Land Cover Map](image_url)

**Fig 3: 1986 Land use/Land cover Map of the Study Area**
Source: Field Survey, 2020
Fig. 4: 1990 Land use/Land cover Map of the Study Area
Source: Field Survey, 2020

Fig 5: 1999 Land use/Land cover Map of the Study Area
Source: Field Survey, 2020
The Land-use/Land-cover maps for the four years of the study depicting the five Landuse/land-cover classes were generated and presented in Fig. 3, 4, 5 and 6. The area and percentage coverage of each of the class is further depicted in Table 1.

From the analysis, Table 1 shows the various land cover types and the proportion of the total area occupied by each of them. The result generated from 1986 LandSat MSS (Fig. 3) indicates that agricultural land occupied the highest proportion of the total land accounting for more than half of the entire area (51.4%), followed closely by bare land (29.2%) while forest, built-up and water body amounted to 13.9%, 4.7% and 0.8% respectively.

The image classification resulted from 1990 LandSat TM (Fig 4), shows that agricultural land remains the major land use land cover with an increase to 52.5%. Bare land and forest has decreased to 27.8% and 13.8% while built-up and water body increased slightly by 5.0% and 1.0%.

Results generated from LandSat ETM 1999 (Fig 5) still recorded an increase in the proportion of agricultural land (63.4%) and built-up areas (5.4%) while forest, bare land and water body still experienced a tremendous decline by 13.5%, 17.1% and
13.5% within that same study period. The analysis further generated from Landsat 8 OLI (Fig 6) revealed that agricultural land and built-up increased dramatically by 72.4% and 5.8% respectively. Forest, bare land and water body decreased to 9.9%, 11.8% and 0.1%. This implies that agricultural land and built-up is fast encroaching into the forest land. The increase in built-up as well as agricultural land was as a result of increase in human population which is presumably due to both migration and natural increase which has given rise to higher demands for agricultural land as well as physical development like residential, commercial, infrastructural and other urban structure. In the quest to meet up with these demands, some of the forest/vegetation land in the area was replaced by these land use classes.

The pressure on the land as a result of increase in the demand of land together with inadequate planning led to the encroachment of built-up and agricultural land on the other area occupied by forest and other land cover types irrespective of the consequences. The dramatic increase in conversion of land for physical development and agricultural activities led to decrease in bare land and water bodies. However, bare surfaces could be seen in built-up area as paved or unpaved land during construction; in cultivated lands during cultivation or after harvesting; along river course as deposition; in forests due to clearing as well as along or on roads mostly when it is unpaved.

**Land-use/Land-cover change**

The result of land-use/land-cover change of the study area between 1986-1990, 1990-1999, 1999-2019, and 1986-2019 is presented in Table 2.

<table>
<thead>
<tr>
<th>Table 2: Extent of Land-use/Land-cover change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land use</td>
</tr>
<tr>
<td>Bare land</td>
</tr>
<tr>
<td>Built up</td>
</tr>
<tr>
<td>Agric/land</td>
</tr>
<tr>
<td>Forest</td>
</tr>
<tr>
<td>Water</td>
</tr>
</tbody>
</table>

Source: Field Survey, 2020

Table 2 revealed the extent of change of change in the land use/land cover in the study area. In 1986 to 1990 forest, bare land and water body decreased by -1.2%, -4.9% and -43.5% respectively. Built-up and agricultural land which is an attribute of urban growth increased by 7.0% and 2.2%. Similarly, from 1990 to 1999, built-up increased by 8.2%, agricultural land by 20.7%, water body by 31.2% while forest and bare land experienced a negative change by -1.8% and -36.5%. This may be due to the creation of a Giwa Local Government Area in 1991. More so, in 1999 to 2019, built-up, agricultural land and water body increased drastically by 7.5%, 14.2% and 2.9% while forest bare land decreased by -26.7% and -33.0%.

Lastly, the extent of the change in land use/land cover between 1986-2019 revealed that, built-up and agricultural land increased drastically by 24.3%, 40.9% within the 28 years study period. On the other hand, forest reduced by -28.8%, bare land by -59.5% and water body -92.0% The result showed a clear indication that physical development has taken over. The increase in physical development coupled with inadequate monitoring of the forest reserve led to the encroachment.

The sharp increase was attributed to the development in transport network, presence of some basic amenities, primary health care as well as the movement of Ahmadu Bello University Teaching Hospital (ABUTH) from Kaduna, Tudun-wada and Malumfashi to its present permanent site in 2005. These act as a pull factor by creating employment and commercial activities in the area. These trigger the increased in population as well as physical development. The increasing urbanization resulted in the removal of forest cover in the area mostly for the purpose of construction, cultivation, cooking energy and electric poles. The increasing urbanization has also led to a higher demand for available land in the area as seen in Figs. 7 below which shows the chart of the classified land use/cover change.
From the analysis, it was observed that built-up and agricultural land witnessed a significant change at the expense of the forest. Under a high population pressure, it is therefore natural to expect some expansion in cultivated land as it reflects land exhaustion such that no much uncultivated land was available, a consequence of these is much; pressure must be applied to the already existing cultivated land into more intensification of farming activities.

Furthermore, this significant reduction in other land use/land cover types could be attributed partly to urban expansion or population growth as well as increased in agricultural activities especially within and around the forest as seen in Fig 4 to meet with the growing demands of the growing population in the area. The study provided an insight on the effect of urban encroachment on Guga forest reserve in Giwa Local Government Area of Kaduna State. The finding of this research revealed evidence of gradual urban expansion over the study period as the land cover had percentage coverage of 4.7% in 1986, 5.0% in 1990, 5.4% in 1999 and 5.08% in 2019. The built-up area and agricultural land have shown a continuous increased within the period of study while forest/vegetation and bare land declined. However, the analysis revealed that builtup and agricultural land has eating up the forest land, most part of the study area is still rural as most people within the study area still engage in agricultural activities. The period 1986-1990 recorded the highest annual growth (1.7%) while the average annual growth rate within the study period (1986 - 2019) was 0.9%. Unplanned expansion has led to conversion of forest and bare land into physical development. The highest proportion of forest loss was noticed between 1990 - 1999 with an annual rate of 0.2%, within this same study period, about 19.6 hectares of land which amounted to about 8.2% was added to built-up land.

IV. CONCLUSION

This study reveals high rate of urban encroachment in the Guga forest reserve area. There is serious encroachment of physical development and cultivation on the forest cover. These could be attributed to unplanned urban growth and inadequate monitoring of the forest reserve. If this situation continues at this rate, the vegetation cover in the area would soon be lost to the detriment of the environment. A cursory observation on Guga Forest reveals that a section of the forest has been degraded through activities like fuel wood harvesting, timber logging, agricultural activities, animal grazing, bush burning and rapid urban growth. These changes if unchecked, in the long run can create serious environmental problems like soil erosion, sedimentation of river channels, loss of soil productive capacity, loss of biodiversity.

V. RECOMMENDATIONS

Based on the identified changing nature and rate of various land-use/land-cover types identified in the study area especially from 1986 to 2019, the following are recommended:

- Proactive measure should be taken by all stakeholders in Giwa Local government area and Kaduna State towards a better understanding of the changing pattern of land-use and land-cover types of the area to be better equipped in order to manage various environmental challenges that might be associated with such changes.
- The management of Guga forest reserve should adopt Remote Sensing and Geographic Information System (GIS) techniques which have proved to be efficient in the monitoring of vegetation cover. This would help to control encroachment and illegal logging in the area.
- Aforestation and reforestation should be encouraged and adopted by the Ministry of Environment and Natural Resources in the State especially around the study areas.
in order to resuscitate lands that are devoid of vegetal cover.

REFERENCES


AUTHORS

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Faster The Slow Running RDBMS Queries With Spark Framework

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Abstract: Data is increasing day by day due to increase of the advanced internet technology, online browsing, Internet banking and online shopping. Modern Technology has helped the humankind to access and communicate anywhere in world very easily. This advanced technology drives the increase of data day by day.

Most of the companies traditionally maintain the transactional data in the Relational Data Base systems like Oracle, SQL Server, MYSQL etc. Every Organisation will have the daily reporting, weekly reporting, and monthly reporting on the collected data. Due to increase in the volumes of data from Terabytes to Petabytes, the processing of the complex queries for reporting in the RDBMS was really time taking and slow.

The usage of Spark to process these reporting complex queries will be 10 times faster than the actual processing of the data in the RDBMS. In General , the RDBMS uses the single node of the cluster to process the query and it is really time taking to process the complex queries used for daily ,weekly and monthly reporting as it got complex joins and multiple aggregate functions involved in it. But spark leverage all the nodes in the clusters to process the data very quickly by using the partitions in the table to break into small chunks and achieve the level of Parallelism to process 10 times faster than the RDBMS.

This Paper talks about how the RDBMS reporting scripts performance can be improved by incorporating the Spark framework without changing the existing queries in the RDBMS.

Index Terms- RDBMS;HDFS;Spark

I. INTRODUCTION

Reporting of the data in daily basis, Weekly, Monthly, and yearly is very crucial for any organization to make the key decisions. Reporting is key for analysis of the data.

Data Reporting is a tool which is used to analyse the current, past and the future prediction for the business decisions. This data used for reporting helps in making key decisions in both operational and strategical [1]. Data Reporting will help the management to take the past data and forecast the future trends and to take the decisions how well the business is operating.

Data is increasing a lot every day due to usage of IOT devices and internet. Traditionally transactional data for any organisation is maintained and stored in the Relational Data Base Systems. RDBMS databases are stable and well established and easily to handle the data in efficient way. Data in RDBMS are consistent and reliable so most of the organisation in different sectors like banking, retail and health industry prefer RDBMS for transactional data storage. [2] Due to increase of the data it becomes hard for the RDBMS to run the queries required for daily, weekly, monthly, and yearly reporting.

Reporting is key for any organisation to make the managerial decisions whether a particular product or service is making profits or to check how it is functioning. These queries run for long time as the RDBMS runs the query on single node on the cluster. If these jobs get failed due to heavy data and this will impact the business operations and impact the key decisions to be taken for effective functionality by management. This Paper highlights the importance of reporting and comes with solution how to make these long running queries to run quickly by making use of spark without any
modifications in scripts or compromising the volumes of the data. Spark is a framework which process the data by in memory process by using the multiple nodes in the cluster by parallel processing to run the queries quickly. Spark [3] process these reporting queries 10 to 100 times faster than Relational Database Management Systems with the inbuilt factors of Parallelism and fault tolerance.

Relational Database System (RDBMS) [4] is a database that stores the data in the structured format in form of rows and columns. This helps to locate the specified data or values required in the database. The data in the database are organised in the tables. It searches the data in the database by querying.

Hadoop Distributed File System (HDFS) [5] is a distributed file system that handles large volumes of data on the commodity hardware. It is highly fault tolerant and support the applications that have large datasets. It Supports both Streaming and batch data.

Spark [6] is a data processing engine which supports large volumes of data. The processing of the data through spark is 100 times faster than traditional system processing as it does the in-memory computation. It uses the built-in features like Parallelism and Fault-tolerant to scales distributed large data workload across the multiple nodes on the large cluster.

II. PROBLEM STATEMENT

A. Existing System:
RDBMS is capable to process the small volumes of the data very quickly. But if there is large volumes of data to be processed for reporting in daily, weekly, Monthly and yearly basis the queries required to pull these data from database and processing will take long time and sometimes it might break as RDBMS uses single node in a cluster to process the data. As the RDBMS does not process the data in parallel and it will take long time to execute the SQL queries and get the required report. Queries need to be optimised and need lot of manual effort to optimise the scripts and need DBA help to limit the jobs to reduce the CPU usage in the server.

B. Proposed System:
Existing System issues can be overcome by making using of spark framework to process large volume of data without any changes in the existing SQL scripts. This Paper will explain in clear how it can be achieved and explains the implementation.

C. Spark Architecture:

Spark is a framework which is used to process and analyse the large volumes of datasets with the distributed computing system. Spark implements the architecture of master and slave which uses one master and multiple worker nodes. Spark driver will go through its own java process and it also controls the workers machines i.e. executors have its own process.

From the Figure 1 it is clear spark applications are launched on the multiple machines by using the cluster manager. Cluster Manager can be standalone or the YARN, Mesos, Kubernetes etc and these are managed by the Resource Manager [8].

D. Functionality of the Spark Framework:

A spark driver launches the job, and it coordinates between the Master and the Executors. It invokes the main applications and launches the spark context. Spark driver has DAG scheduler, task scheduler, backend scheduler and block manager.
When a job is submitted to the Spark for processing, spark context is created by the spark driver and it request for the resources from the cluster manager and it launches the executors. Spark driver runs the main application and the actual codes and split the tasks among the executors. Executors will run the tasks and sends the output back to the driver [9].

III. IMPLEMENTATION

In this Paper I am taking the implementation of running the MYSQL queries with Spark. This can be extended to any RDBMS databases.

Spark can be connected to any RDBMS database by using the required database jdbc driver. Through that jdbc driver spark can connect to the database and can start running the queries on top of it.

A. Connecting Spark to MYSQL Database:

To connect Spark Engine to the MYSQL database mysql-connector jdbc driver [10] need to be installed either on the hdfs i.e. Hadoop distributed file system or on the spark to call from the spark shell.

The below code needs to be executed to connect spark to MYSQL

```
val url = “url of the mysql”
val prop = new java.util.Properties
  prop.setProperty(“username”, “username of MYSQL “)
  prop.setProperty(“password”, “password of MYSQL “)
  prop.setProperty(“driver”, “com.mysql.jdbc.Driver”) 
```

B. Configuring the Connection String to connect to MYSQL:

After connecting to the MYSQL with spark shell. Username and password of the database needs to authenticate to connect to a specific database to read the table from the database.

Below code snippet needs to be executed to read the table from the MYSQL database

```
val df =
  spark.read.format(“jdbc”).option(url,table,prop)
```

C. Reading the MYSQL Table and Storing data in Database:

By using the above configuration string, we can connect to the specific database and table in the MYSQL and the data can be stored in the memory temporarily.

Below code snippet needs to be executed to read and store the data in data frame

```
val df =
  df.createTempView(“temptablename”) 
```

D. Creating temporary table on Data Frame:

We can register the dataframes as temporary table or view and can perform the SQLK operation on top of it.

Below is the code snippet to connect to the create temporary table

```
df.createTempView(“temptablename”) 
```
We can do any SQL operations on top of this temporary table which we used to run in the MYSQL databases.

Below is the sample code snippet how to run the SQL queries on top of the temp view/table

```scala
val result = spark.sql("select count(*) from temptable")
```

These processed query result can be written back to the MYSQL database or even can be save as any type of file format like csv, excel etc.

Writing Result back to MYSQL data frame:

```scala
val table =" dbname.tablename"
result.write.mode("append").jdbc(url,tablename,
```

IV. FINDINGS

The processing of the same query in the MYSQL i.e. RDBMS is slower when compared with the spark processing. If the query takes minutes to process the data in RDBMS it will be completed in seconds with the spark due to the in-memory computation

V. CONCLUSION

This paper talks about the research I performed how the performance of the long running queries can be improved in RDBMS by using the Spark Framework. Reporting is a key factor for any organisation and most of the transactional data is stored in the RDBMS but RDBMS takes long time to process the long reporting data so the proposed solution of connecting spark to the RDBMS database and then process the same queries without any chances will solve the problem of data delay and slow processing data.

This Paper clearly explains the implementation with the code which can be used to connect any RDBMS database to improve the performance of processing the data.

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Cranial CT Evaluation of Linear Measurements in Children with Hydrocephalus in Sokoto, Nigeria

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Abstract- Introduction: The term hydrocephalus literally means “water in the brain” and in this condition, excess fluid accumulates in the brain resulting in dilatation of the ventricles. It results from imbalance between cerebrospinal fluid (CSF) production and absorption. The extent of ventricular dilatation and brain compression in hydrocephalus in children is often significant and if untreated can lead to complications such as blindness and mental deficiency. Therefore assessment of cerebral ventricular size is essential in the clinical management of hydrocephalus.

Aim: To evaluate hydrocephalus using linear measurements such as Evan’s ratio and cerebral mantle thickness on CT images in children with hydrocephalus in Sokoto, Nigeria and also compares the findings with that of other regions.

Methods: This is a four year (January 2009 – December 2013) retrospective study of 100 consecutive paediatric patients aged 0–14 years with CT diagnosis of Hydrocephalus in Radiology Department, Usman Danfodiyo University Teaching Hospital Sokoto. The patients CT images were retrieved from the memory of the CT scanner and the back-up recordable CDs in the CT suite of the Department. The linear measurements including maximum frontal horn distance (FHD), maximum transverse inner skull diameter (ISD) and cerebral mantle thickness were taken in axial images. The Evan’s index (EI) was determined as FHD/ISD. The data was analyzed using statistical package for social sciences (SPSS) version 20.

Results: A total of 100 hydrocephalic patients who had brain CT were studied. The mean age was 3.3 ± 3.7 years with a range of 5 days to 14 years. The highest number of patients (64) was recorded in the age group 0–3 years. The mean EI was found to be 0.49 and the mean cerebral mantle thickness was 17.5 mm and 16.6 mm on the right and left side respectively. A statistically significant relationship was observed between EI and the type of hydrocephalus. EI was found to be higher in congenital (p = 0.015) and non communicating hydrocephalus (p = 0.017).

Conclusion: The mean EI in this environment (0.49) is found to be lower than the one reported in Lagos Nigeria but higher than the indices reported in other regions of the world. However, we found EI to be higher in children aged less than three years and in congenital as well as non communicating hydrocephalus as reported by previous studies in other regions.

Index Terms- Hydrocephalus, Children, Computed tomography, Linear measurements

I. INTRODUCTION

The term hydrocephalus literally means “water in the brain” and in this condition, excess fluid accumulates in the brain resulting in dilatation of the ventricles\(^1\). It results from imbalance between cerebrospinal fluid (CSF) production and absorption. The cause of hydrocephalus is either congenital or acquired. Hydrocephalus is also classified as communicating or non communicating. In communicating hydrocephalus there is free communication between the ventricles and basal cisterns; while in non communicating hydrocephalus there is obstruction to the flow of CSF within the ventricular system\(^2\).

The extent of ventricular dilatation and brain compression in hydrocephalus in children is often significant and if untreated can lead to complications such as blindness and mental deficiency\(^3\). Therefore assessment of cerebral ventricular size is essential in the clinical management of hydrocephalus. Various imaging methods play roles in the evaluation of hydrocephalus with each having its limitations. Plain radiography of the skull shows features of raised intra cranial pressure which is non specific for hydrocephalus. Ultrasonography is unsuitable in older children with fused fontanelles. Magnetic resonance imaging (MRI) has excellent soft tissue resolution but has a long time of acquisition of images which make sedation necessary in children. Computed tomography (CT) on the other hand is rapid, compatible with life support devices and often requires no sedation in children\(^4\). Computed tomography plays a central role in diagnosing hydrocephalus and also in the evaluation of treatment options, follow up and monitoring of patients\(^5\).

This study is intend to evaluate hydrocephalus using linear measurements such as Evan’s ratio and cerebral mantle thickness on CT images in children with hydrocephalus in Sokoto, Nigeria and also compares the findings with that of other regions.

II. MATERIALS AND METHOD

Study design: This is a four year (January 2009 – December 2013) retrospective study of 100 consecutive paediatric patients aged 0 – 14 years with CT diagnosis of Hydrocephalus. Cranial CT was performed at the Radiology Department Usman Danfodiyo University Teaching Hospital (UDUTH) Sokoto, North Western Nigeria.

Methods: All patients had brain CT scan using the spiral dual slice computed tomographic scanner of Phillip Neusoft,
manufactured 2003. Contiguous axial 5mm slices were obtained pre and post intravenous contrast medium from vertex to the base of the skull. Images were reformatted in coronal and sagittal sections and stored in the memory of the CT scanner before being copied on LG recordable CDs.

In this study the patients’ biodata and clinical diagnosis were retrieved from the Departmental archives. The patients CT images were retrieved from the memory of the CT scanner and the back-up recordable CDs in the CT suite of the Department.

**Technique of CT:**

Cranial CT scans were obtained using the normal departmental protocol as follows:

After making sure there is justification for the brain CT, a brief history regarding allergy or previous reaction to contrast medium was taken. The procedure was then explained to the patient/informant. The patient then lies or was made to lie in the supine position on the CT couch. The head is placed on the head rest and supported using head immobilization pads with strap. Wedge pads and strap are used to maintain the correct head position. The couch, with the patient, was introduced into the gantry. In order to prevent unnecessary irradiation of the orbit and especially the lens, the head CT was performed with the gantry set at an angle parallel to the base of the skull. The laser beam was used for indicating the start and end points of the scan. Uncooperative patients were sedated with intravenous diazepam at a dose of 0.1mg/kg. The scout image (scanogram) was acquired from the operating console.

The scanogram was then assessed to plan axial sections of the cranium obtained from vertex to the base of the skull with slice thickness of 5mm, matrix size of 256 x 256, field of view (FOV) = 250mm, window width = 80 and window level = 40. The images were then inspected for presence or absent of acute intracranial haemorrhage and then intravenous contrast medium administered at a dose of 1ml/kg. Post contrast axial images were also obtained. Patients with acute intracranial haemorrhage were not given contrast medium. The obtained images were then reformatted in the sagittal and coronal planes.

The images were reported by consultant radiologist. All CT images were re-evaluated by three radiologists to reduce observer bias. The linear measurements were taken in axial images as follows:

- **Maximum frontal horn distance (FHD);** Transverse distance between the lateral margins of the right and left frontal horns of the lateral ventricle at the level of foramen of Monro (fig 1) or at the level of maximum dilatation of the frontal horns if the foramen of Monro is not identified on the image\(^6\).

- **Maximum transverse inner skull diameter (ISD);** The maximum diameter between inner margin of the skull measured at the same axial level where the FHD was measured\(^6\) (fig 1).

- The Evans ratio was determined as the ratio of the FHD and ISD i.e. FHD/ISD\(^6\).

- **Cerebral mantle thickness (CMT);** The transverse distance between lateral margin of the anterior horn of the lateral ventricle at the point of maximum dilatation and inner margin of the skull\(^6\) (fig 2)
FIGURE 1: Unenhanced axial CT brain in a child with hydrocephalus at the level of the maximum frontal horns dilatation showing measurements of the maximum frontal horns distance (a) and maximum internal skull diameter (b).
Patients with ventriculo-peritoneal (VP) shunt tube in situ and those with brain atrophy evidenced by CT findings of dilated extraventricular CSF spaces were excluded in the study.

III. DATA ANALYSIS

Patients’ biodata and radiological measurements were then recorded in the proforma and data was analyzed using statistical package for social sciences (SPSS) version 20. Analysis of descriptive statistics using mean and standard deviation (SD) for quantitative data (age, CMT and Evans ratio) and frequencies for qualitative data (gender and type of hydrocephalus) was done. This was followed by inferential statistics using Chi square test to determine associations between categorical variables and independent t test was done for continuous variables. The result was presented in form of tables. All statistical tests were carried out using a two tail test, with level of significance set at 0.05. Ethical approval to conduct the study was obtained from the ethical committee of UDUTH Sokoto.

IV. RESULTS

A total of 100 hydrocephalic patients who had brain CT were studied. Sixty two (62) of the patients were male and 38 were female with male/female ratio of 1.6:1 (table 1). The mean age was 3.3 ± 3.7 years with a range of 5 days to 14 years. The highest number of patients (64) was recorded in the age group 0-3 years. There was a gradual decrease in the number of patients with increasing age (table 1).

Table 1: Age distribution of patients.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male</th>
<th>Female</th>
<th>Frequency N/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>36</td>
<td>28</td>
<td>64</td>
</tr>
<tr>
<td>4-6</td>
<td>11</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>7-9</td>
<td>5</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>10-12</td>
<td>7</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>13-14</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>38</td>
<td>100</td>
</tr>
</tbody>
</table>
The majority of the cases of hydrocephalus were the congenital type consisting of 54 patients with an incidence of 54% while the acquired hydrocephalus was found in 46%. Non communicating hydrocephalus was the predominant form occurring in 59 patients but the difference was not statistically significant (table 2).

### Table 2: Type of hydrocephalus among study patients

<table>
<thead>
<tr>
<th>Type of hydrocephalus</th>
<th>Frequency (N)</th>
<th>%</th>
<th>Test statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital</td>
<td>54</td>
<td>54</td>
<td>One sample binomial test</td>
</tr>
<tr>
<td>Acquired</td>
<td>46</td>
<td>46</td>
<td>P = 0.194*</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Communicating</td>
<td>41</td>
<td>41</td>
<td>One sample binomial test</td>
</tr>
<tr>
<td>Non communicating</td>
<td>59</td>
<td>59</td>
<td>P = 0.089*</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

*P > 0.05- Not statistically significant.

The mean cerebral mantle thickness (CMT) was 17.5mm ± 10.3 on the right side and 16.6mm ± 9.4 on the left (table 3). There was statistically significant relationship between the cerebral mantle thickness and the type of hydrocephalus. Non communicating hydrocephalus was found to be associated with less CMT implying more cerebral mantle thinning than communicating hydrocephalus (p = 0.017 and p = 0.005 on the right and left sides respectively) as shown in table 4.

### Table 3: Cranial CT measurements.

<table>
<thead>
<tr>
<th>Variable (mm)</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMT (right)</td>
<td>0.5</td>
<td>37</td>
<td>17.5</td>
<td>10.3</td>
</tr>
<tr>
<td>CMT (left)</td>
<td>0.9</td>
<td>35</td>
<td>16.6</td>
<td>9.40</td>
</tr>
<tr>
<td>FHD</td>
<td>36</td>
<td>82</td>
<td>51</td>
<td>7.4</td>
</tr>
<tr>
<td>ISD</td>
<td>89</td>
<td>149</td>
<td>108</td>
<td>8.3</td>
</tr>
<tr>
<td>Evan’s ratio</td>
<td>0.31</td>
<td>0.89</td>
<td>0.49</td>
<td>0.13</td>
</tr>
</tbody>
</table>

CMT: Cerebral mantle thickness  
FHD: Frontal horn distance  
ISD: Internal skull diameter

| Table 4: Cerebral mantle thickness by type of hydrocephalus  

<table>
<thead>
<tr>
<th>Type of hydrocephalus</th>
<th>Mean cerebral mantle thickness (mm)</th>
<th>Test statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>Communicating</td>
<td>20.390 t = 2.431</td>
<td>19.195 t = 2.871</td>
</tr>
<tr>
<td>Non communicating</td>
<td>15.432 df = 98</td>
<td>13.014 P = 0.005*</td>
</tr>
</tbody>
</table>

The mean Evan’s ratio was 0.49 ± 0.13. The mean Evan’s ratio was found to be higher in the age range 0-3 years. There was gradual decrease in Evan’s ratio with age group of patients with the lowest value recorded in 12-14 age group (table 5). A statistically significant relationship was observed between Evan’s ratio and the type of hydrocephalus (table 6). Evan’s ratio was found to be higher in congenital (p = 0.015) and non communicating hydrocephalus (p = 0.017).
Hydrocephalus is associated with higher cranial pressures, which can lead to an increase in intracranial volume. The differences in the mean cranial pressure between children aged less than three years and those above three years old have been studied, with a higher mean cranial pressure noted in the younger group. Mesiwala AH et al. also reported a lower mean cerebral mantle thickness in children below three years compared to those above three years. A similar finding was reported with an index of 0.47 and 0.31 for children with congenital hydrocephalus and older age group of patients in this study.

The mean cranial pressure in this study was 17.1 mm (17.5 mm on the right and left cerebral hemispheres respectively). The higher value of mean cranial pressure in this study may be due to inclusion of tumorous hydrocephalus and older age range of patients studied. A statistically significant association was found between the type of hydrocephalus and cranial pressure (p = 0.015). This trend was consistent with the findings of Venatharamana et al. in a study evaluating the functional outcome of congenital hydrocephalus. Idowu et al. also found a significantly higher Evan’s ratio in the congenital (p = 0.015) and non communicating (p = 0.017) types of hydrocephalus (table 6).

In this study the mean Evan’s ratio was found to be 0.49 (table 3). This value is at variance with findings of Idowu et al. in a study of non tomorous hydrocephalus in 137 children below age of six in Lagos Nigeria who reported a higher mean Evan’s ratio of 0.56. Erol et al. reported a lower value of 0.45 in their study including 27 hydrocephalic children below the age of six months with pre-operative cranial CT. Radhakrishna P in a study titled evaluation of Evan’s index by CT in hydrocephalic children also reported a lower mean EI of 0.43. The differences in the mean Evan’s ratio may be due to the inclusion of tumorous hydrocephalus and older age group of patients in this study.

A relationship between the age range of patients and Evan’s ratio was observed in the index study. The highest ratio of 0.76 was found in the age range of 0-3 years. There was gradual decrease in ratio with increasing age of patients with the lowest value of 0.36 noted in 12-14 years age group (table 5). This trend was consistent with the findings of Radhakrishna P in which he reported an index of 0.47 in children below 3 years higher than in those above 3 years old (0.38). Mesiwala AH et al. also reported similar findings with an index of 0.47 and 0.31 for children with congenital hydrocephalus age 1.6 years and 5 years respectively. Hydrocephalus in children may be congenital or acquired. It may also be communicating or non communicating depending on the site of the obstruction to the normal flow of the CSF. It has been reported that congenital hydrocephalus is associated with higher Evan’s index than the acquired hydrocephalus. In this study we also found a significantly higher Evan’s ratio in the congenital (p = 0.015) and non communicating (p = 0.017) types of hydrocephalus (table 6).

The mean cortical mantle thickness in this study was 17.1 mm (17.5 mm on the right and left cerebral hemispheres respectively as in table 3). However, Idowu et al. in their study reported a lower mean cortical mantle thickness (10.8 mm). The higher value of mean cranial pressure in this study may be due to inclusion of tumorous hydrocephalus and older age range of patients studied. A statistically significant association was found between the type of hydrocephalus and cranial pressure (p = 0.015). This trend was consistent with the findings of Venatharamana et al. in a study evaluating the functional outcome of congenital hydrocephalus. Idowu et al. also reported similar findings.

**Table 5**: Cranial CT measurements by age group.

<table>
<thead>
<tr>
<th>Age range (yrs)</th>
<th>Mean cerebral mantle thickness (mm)</th>
<th>Mean Evan’s ratio (FHD/ISD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>0 – 3</td>
<td>13.3</td>
<td>11.4</td>
</tr>
<tr>
<td>4 – 6</td>
<td>15.1</td>
<td>18.3</td>
</tr>
<tr>
<td>7 – 9</td>
<td>18.1</td>
<td>18.5</td>
</tr>
<tr>
<td>10 – 12</td>
<td>18.5</td>
<td>19</td>
</tr>
<tr>
<td>13 – 14</td>
<td>22.6</td>
<td>15.8</td>
</tr>
</tbody>
</table>

FHD – Frontal horn distance
ISD – Internal skull diameter

**Table 6**: Comparison of mean Evan’s ratio between different types of hydrocephalus

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean Evan’s ratio</th>
<th>Test statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of hydrocephalus</td>
<td></td>
<td>stal = 2.321</td>
</tr>
<tr>
<td>Congenital</td>
<td>0.561</td>
<td>df = 98</td>
</tr>
<tr>
<td>Acquired</td>
<td>0.417</td>
<td>p = 0.015 *</td>
</tr>
<tr>
<td>Communicating</td>
<td>0.394</td>
<td>df =98</td>
</tr>
<tr>
<td>Non communicating</td>
<td>0.580</td>
<td>P = 0.017 *</td>
</tr>
</tbody>
</table>

*p < 0.05 – Statistically significant.

**V. DISCUSSION**

Evan’s ratio or index and cerebral mantle thickness gives indication of degree of ventricular dilatation in patients with hydrocephalus. Evan’s index (EI) is defined as ratio of maximum frontal horn diameter to maximum transverse diameter of the skull. Ventricular enlargement is when the EI is greater than or equal to 0.3. In this study the mean Evan’s ratio was found to be 0.49 (table 3). This value is at variance with findings of Idowu et al. in a study of non tomorous hydrocephalus in 137 children below age of six in Lagos Nigeria who reported a higher mean Evan’s ratio of 0.56. Erol et al. report a lower value of 0.45 in their study including 27 hydrocephalic children below the age of six months with pre-operative cranial CT. Radhakrishna P in a study titled evaluation of Evan’s index by CT in hydrocephalic children also reported a lower mean EI of 0.43. The differences in the mean Evan’s ratio may be due to the inclusion of tumorous hydrocephalus and older age group of patients in this study.

A relationship between the age range of patients and Evan’s ratio was observed in the index study. The highest ratio of 0.76 was found in the age range of 0-3 years. There was gradual decrease in ratio with increasing age of patients with the lowest value of 0.36 noted in 12-14 years age group (table 5). This trend was consistent with the findings of Radhakrishna P in which he reported an index of 0.47 in children below 3 years higher than in those above 3 years old (0.38). Mesiwala AH et al. also reported similar findings with an index of 0.47 and 0.31 for children with congenital hydrocephalus age 1.6 years and 5 years respectively. Hydrocephalus in children may be congenital or acquired. It may also be communicating or non communicating depending on the site of the obstruction to the normal flow of the CSF. It has been reported that congenital hydrocephalus is associated with higher Evan’s index than the acquired hydrocephalus. In this study we also found a significantly higher Evan’s ratio in the congenital (p = 0.015) and non communicating (p = 0.017) types of hydrocephalus (table 6).

The mean cortical mantle thickness in this study was 17.1 mm (17.5 mm on the right and left cerebral hemispheres respectively as in table 3). However, Idowu et al. in their study reported a lower mean cortical mantle thickness (10.8 mm). The higher value of mean cranial pressure in this study may be due to inclusion of tumorous hydrocephalus and older age range of patients studied. A statistically significant association was found between the type of hydrocephalus and cranial pressure (p = 0.015). This trend was consistent with the findings of Venatharamana et al. in a study evaluating the functional outcome of congenital hydrocephalus. Idowu et al. also reported similar findings.

**VI. CONCLUSION**

The mean Evan’s index (EI) of hydrocephalic children in this environment is found to be 0.49 and the mean cortical mantle thickness is 17.5 and 16.6 mm on the right and left cerebral hemisphere respectively. This mean EI is lower than the one reported in Lagos Nigeria but higher than the indices reported in other regions of the world. However, we found EI to be higher in children aged less than three years and in congenital as well as non communicating hydrocephalus as reported by previous studies in other regions.
REFERENCES


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Abstract- Regardless of the mobile applications available in smartphones, the veterinary hospitals in Sri Lanka still use the manual books to fill the vaccination schedule and keep track of pet care. This research is an attempt to change this tradition by introducing a smart system for dogs. The system can be used both by dog lovers and veterinary doctors. In this study, new proposed application plan is to replace the traditional method with a method that can store the information into a system and make it available for the users to take care of the dog. Since the dog's birth, the information can be stored and it will assist the pet owners. Unlike other applications available, the advantage of this application is that the user can choose applications to be used individually or integrated according to their choice.

Index Terms- machine learning, web scraping, IoT, image processing

I. INTRODUCTION

The system’s purpose is to make a leap from manual to the automated system that can have the information about the dogs. The application focuses on four main features to build up an overall application that can work on smartphones.

Health care is essential for any living being. Considering all the factors breed, age, weight, Gender, and height; exercises, vaccinations, and nutrition plans are generated to suit individual dogs. The owner will be notified through notification alerts when the dates for vaccinations are nearby.

When dogs get skin diseases most of the time, the owners do not have an idea about it and are unaware that some of the skin diseases can transmit to humans. The studies say warm countries like Sri Lanka have a high risk of spreading skin disease quickly, primarily ringworm which spreads by fungus.

Finding the right dog breed is the first and most important decision for dog lovers. Only the dogs registered in the system are allowed to go through selling or for cross purposes. The system improves buyers’ reliability by providing dogs’ medical history with certification from the veterinary doctor. The chat box helps users with the information. Dog lovers can know the originality of the breed. Sellers can sell dogs conveniently through scraping websites platforms. The app will help build a bridge between dog sellers and buyers in a more productive way.

Finally, introducing the dog tracking system makes owner’s lives much more comfortably, especially during a busy schedule. Using the automated feeding machine, the owner can feed their dogs anytime from anywhere using their mobile phones. This automated system can also help owners monitor their dog’s diet. The overall system mainly focuses on helping users take care of their dogs at fingertips through smartphones with the help of the information fed by the user.

II. RELATED WORK

There are mobile applications available in smartphones, but veterinary hospitals still practice the manual method by filling the books. The studies in the following four different fields have been combined in together this proposed system.

A. Predicting the dog’s health and generating plans

According to the research paper which has written by S. K. Helmink, E. A. Leighton and R. D. Shanks highlighted that the existing variety [1]. An adult dog guide is 18 to 32 in weight. The weight of German Shepherd male and female dogs were checked between the birth and 18 months of age, ensuring that at least one record of weight after 290 days of age. The construction of growth curves were done using 10,484b observations from 880 dogs. And Gompertz function in the form Wt=Wmaxexp (-e-[(t-c)/b]), is used to construct that curves. In this Wt is weight at time t, Wmax is mature body weight, b is proportional to duration of growth, c is age at point of inflection, and t is age in days. The body mature estimations show that it is 2.4+0.3 kg higher for Labrador retrievers than for German shepherd dogs and 4.7+0.2 kg higher for males than females. It is shown that the Male Labrador retrievers were the closest to upper limit of desirable weight. It is an average of 31.4+0.3 kg. 4b+c the duration of growth not different. But, estimation is, for males it is 8+5d longer than for females. While the female Labrador retrievers had the 329+6 days of shortest estimation for growth. While estimation for age for point of infection was not different between breeds, it is 3.6+1.2 d greater for males than the females. It may be helpful that a better reading and understanding of the growth curves in estimating mature weights at young age. Therefore, the allowing of earlier breeding and training decisions to be taken and the generic changing incretion per year.

In the research [2]. Which is done by Amanda J. Hawthorne, Derek Booles, Pat A. Nugent, George Gettinby and Joy Wilkinson. Dogs are quite unique. Body weight changes drastically from breed to breed where dogs such as mastiffs can weigh up to 125kgs while dogs like chihuahuas weigh only 1kg. Growth period and rate of growth of puppies vary exponentially from breed to breed.

To prevent making growing puppies’ under-weight or over-weight standardized feeding plans are to be introduced. Over nutrition will cause obesity in dogs while
musculoskeletal diseases will be triggered in large breeds. Feeding plans available at the moment only provide data that only uses a single equation.

Variations in coat, size and temperament may result in breed specific growth patterns with varying levels of energetic requirements. A study based on puppies from 6 breeds showed different levels of energy requirements even though some had similar body weights. Such as the difference between Newfoundland and great-Danes and that of Labradors and Briards. Information available on breed specific growth of puppies is scarce. These patterns only provide limited data on single breeds. Ex 8 - 34 month old and 6 - 20 week old Labrador retrievers and 12 week old germane shepherds. Other studies are restricted by the use of data from other breeds which makes it difficult to differentiate data from different age groups. Complete growth curves of 12 different sized dog breeds were studied and compared to deduce a scientific and mathematical based feeding plan to dogs.

B. Dog buying and selling platform

There are lots of dog breeds worldwide. There are lots of pure dog breeds among good breeds. Finding the right dog breed is the first and most important decision for dog lovers. When buying a dog, you should have good knowledge to find an exact original breed. According to the survey conducted lots of people response was no.

“Dog species were original, found from candies, native, to a nation or geographical area, and breeding, breeds were chose for phenotypic behavior, such as coat color, size, coat color and structure. Later, breeds were in turn built up from, existing breeds, each substructure, breed giving a phenotypic, trait that species true. Based, on available breed chronicle, the majority of extant dog breeds were developed in the 19th century”. A well-groomed dog’s breed can be recognized easily. However, looking at a puppy, it is challenging to find the breed. That is the main problem. There are lots of unique features, and those are different from breed to breed [3]. There are lot of buying and selling platforms [4]. But there is no specific selling platform for dogs like this. Most give only some information. This is a specific selling platform for dogs. Here, dogs that are only registered and maintained by the system or their registered puppies are allowed to sell or make advertisements on crossing purposes. Dog lovers (buyers) can see a lot of details and be clear about the originality of the breed. All the past details. All the actual photos, medicines, nutrition plans, health, etc. can be seen. There is no opportunity for misunderstanding. It cannot be deceived. All the updates are going with doctor’s supervising.

There is another problem for users when selling dogs. The way of selling dogs conveniently. In a situation when using a different application, there is a problem with finding buyers. There is a lot of buying and selling platforms. But those are using traditional methods to find buyers through advertisements or promotions. Here, system solutions can be generated from using scraping algorithms. Web scraping or web data extraction is data scraping used for extracting data from websites. Find out data through websites platforms about the users’ needs and related platforms. Using a scraping algorithm analyzes the advertisements (who need dogs) from related websites. It is handy for sellers and buyers. This helps to build a bridge between dog sellers and buyers in a more productive way.

C. Automatic pet feeder project

According to the project by Yixing Chen and Maher Elshakankiri, were proposed an automatic pet feeder using IOT and it was a food storage container and a pour-out-food container, a double feeding dish, and a Tower Pro SG90 Micro Servo as the actuator. According to this automation pet feeder, users will be able to give foods to their pets the right amount. [5].

Smart Child Safety Wearable Device is a Global Positioning System (GPS) tracker that gives a solution for kids. What is special about this is the gadget empowers association between the youngster and parent through the WIFI module cooperation utilizing IOT. The parent can get to the kid data intermittently by interfacing through this device [6].

D. Detecting skin diseases

With the collected information in 2020, image processing is growing in many fields, yet its growth in identifying skin diseases is comparably lower than in other fields. Researches have been done using image processing to identify human skin diseases and plant leaf diseases. Image-processing requires a certain amount of pictures to give an accurate result. There are no data sets available for dog skin disease to continue research in image processing. Creating a data set and coming up with classifications is also good progress since there is no specific solution to find out about dog skin disease through image processing. Skin diseases identifying systems for dogs are still under research. There are skin disease identification methods available for humans and plants [7].

The response taken from 43 people who love dogs, more than 25 people welcome the idea of image processing to give a solution. There is no research in the field of dog skin disease to give comparable feedback about this system. Helping a user find out the basic idea of a dog skin disease through image identification might be an excellent hurdle to cross.

Figure 1: Component diagram.
III. METHODOLOGY

The system that is proposed in our research consists of a mobile application. The mobile application is built using flutter. The mobile application can be used by android and IOS environment.

A. Predict the dog health and generating plans

This section describes how details are gathered and generate plans in order to maintain the dog’s health. First the doctor examines the dog and enters the details of the dog to the system. Details such as breed, weight, height, gender, dog’s body type, birthday, name, adult or puppy are taken into consideration. The dog will be registered on the system and a profile will be created. This profile contains vital information about the dog. Information about the medicinal vaccines and nutrition prescribed to the dog will be recorded on the system. According to the details mentioned above we plan to use an algorithm to generate plans for each and every dog’s needs.

A dog is classified mainly into two categories as adult and puppy based on information provided by a government approved veterinary doctor. The one tables below depicting were designed according to the information provided by the veterinary doctor.

Table 1: Adult Body Weight and Height

<table>
<thead>
<tr>
<th>Breed</th>
<th>Height(cm)</th>
<th>Weight(kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>German-Spitz</td>
<td>27-37</td>
<td>8-15</td>
</tr>
<tr>
<td>Doberman</td>
<td>65-69</td>
<td>30-35</td>
</tr>
<tr>
<td>Labrador</td>
<td>54-57</td>
<td>25-34</td>
</tr>
<tr>
<td>Boxer</td>
<td>53-63</td>
<td>25-32</td>
</tr>
<tr>
<td>Great Dane</td>
<td>71-76</td>
<td>46-55</td>
</tr>
<tr>
<td>Pomeranian</td>
<td>23-30</td>
<td>2-3</td>
</tr>
</tbody>
</table>

The data related to Dobermans, German Spitz (pom in India), Labrador, Boxer, Great Dane and Pomeranian breeds were gathered under two major categories. Data from each breed was further categorized into two subdivisions. Adult canine data were analyzed under height and weight whilst puppy data were analyzed under age and weight.

The health of a canine can be determined with the help of machine learning algorithms and deep learning algorithm when the above-mentioned data is entered into the system. Changes in exercises and supplement plans are informed to the user by the system based on the results (overweight, underweight or normal) derived from the algorithms.

By careful analysis of scatter plots for data sets of adult dogs it was observed that they were scattered linearly. Hence the data sets for adult dogs were trained using Support vector (SVM) which is a machine learning algorithm. The accuracy levels reached was high. The output will be health of the dog whether its over-weight, under-weight or normal. The above output determined by checking whether the dog has a weight respective of their height.

Scatter plots related to the data sets for the puppy dogs were analyzed. Using a machine learning algorithm to train data sets for this kind of scatter was difficult due to the low accuracy levels reached. Later high levels of accuracy were obtained by using fully connected deep networks. The output will be health of the dog whether it’s overweight, underweight or normal. The above output determined by checking whether the dog has a weight respective of their age (number of month).

B. Buying and selling platform

This is a specific selling platform for dogs. In here, only the dogs that are registered and maintained by the system or their registered puppies are allowed to be sold or can be advertised for crossing purpose. Users must follow the standards. Anyone can easily register and see the breeds available to sell. All the details will be there. Dogs’ medical history and data of veterinary doctor’s certifications can be seen and users can prove the originality of the breeds. Filtered data are retrieved from the database. Filtered data will not affect the security of the dog. When posting an add users can add photos and details on their own. Users can select the add type (selling or crossing purpose). Chat box helps contact users after posting an advertisement. After selling a dog, users can transfer ownership to the new owners with all of the past details. New owners can continue from there.

Web scraping helps to find who needs dogs and make the selling convenient. Extraction should be matched with users’ data from related web sites. Web scraping is the procedure of extracting model data from web sites and creating structured data. Using scraping algorithm can be extracted by matching data without extracting incorrect data. [8]

Figure 2: Scraping algorithm

1. Automated feeding system

System describes Arduino based dog feeding automation which can automatically serve food to dog timely. System consists 16*02 Liquid Crystal Display (LCD) is to display the time using DS1302 Real Time Clock (RTC) Module. Servo motor is used to rotate the container to provide the food. The owner can set the container opening duration according to the food quantity to serve the dog. Using 4*4 keypad to manually set up the time for feeding the dog as well as this can set by using the mobile application.DS1302 RTC Module, which used to set the time and date on which the dog should be given food. As a result of this set up the time according to the dog’s eating schedule, the device drops or fill the food bowl automatically. By using Global System for Mobile communication (GSM) module, it receives the text message that includes the amount of food from the database. This shield enables Arduino to send and receive data from anywhere in the world with a GSM connection. It is responsible for connection between mobile and Microcontroller.
2. Tracking system

Proposed tracking system is a wearable device for the dog and also a signal generating point for Geo-Fencing purpose. The hardware component consists with a GPS module to get the GPS coordinates from the satellites above. When the user wants to know the location of his pet, he can request it from the mobile application via a Short Message Service (SMS). This SMS will be received for the GSM module at the device attached in dog’s collar and it will send a reply massage for user’s application by including current longitude and latitude information which identified through GPS module.

Geo fence functionality is working through Radio Frequency signal communication method and this needs a separate Radio Frequency (RF) signal transmitter unit placed in garden. Theory behind this is as follows. This RF transmitter always transmits a unique signal in a particular time interval. There is a RF receiver at the hardware device which is attached to dog’s collar. This receiver always checks that transmitted signal for it’s availability. If receiver could not find that transmitted signal, that means the dog has moved to a far location away from the home. Here at this situation, hardware device will send a massage for user by informing it. This massage will contain the current location data of the dog.

D. Detecting skin disease through image processing

Skin disease Identification for dogs, the users in the front end will have a user-friendly interface to input the picture taken by the user and upload it to the mobile application, and the trained data model will compare the picture that uploaded with the trained data set, which used the Convolutional neural networks (CNN) to train.

CNN model is famous for the automatic detection of images like how human brains work. There are four main steps in CNN those are Convolution (REL Layer), Pooling, Flattening, and Full Connection. Detect features of image through CNN is not new but applying it to all new classification is a new step taken here. The 3*3 matrix is used here to summarize the features in the image. In the first step through applying filtered features map to the image break up the linearity of that image using the function rectifier. Then the image become ready for the pooling step where the purpose will be providing CNN with the faculty of “spatial invariance”. After ending up pooling feature map the image will get flatten and added into artificial neural network [9].

IV. RESULTS AND DISCUSSION

As a result of asking Data related to 10 German shepherd puppies (1 month - 13 months), they were taken into the research by visiting the veterinary hospital, and they were analyzed to check whether they had a proper body weight and their age. An error rate of 2.17 was observed by analyzing data of 10 puppies.

The discussion with the veterinary doctor helped understand the zoonotic diseases that can be spread to humans. Got familiar to medical terms with the help of the experience gained by visiting the veterinary hospital.

A. Predict the dog health and generating plans

Data sets of adult dogs were trained using the Support Vector Machine algorithm. The results obtained after using Breed, height and weight as inputs are shown below.

<table>
<thead>
<tr>
<th>Normal</th>
<th>Over-weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 2: Adult Boxer prediction output

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>35</td>
<td>1</td>
</tr>
<tr>
<td>55</td>
<td>28</td>
<td>0</td>
</tr>
<tr>
<td>52</td>
<td>20</td>
<td>-1</td>
</tr>
<tr>
<td>63</td>
<td>35</td>
<td>1</td>
</tr>
</tbody>
</table>

Data sets of puppy dog were trained using the fully connected deep networks. The results obtained after using Breed, age in month and weight as inputs are shown below.

Table 3: Puppy Pomeranian prediction output

<table>
<thead>
<tr>
<th>Months</th>
<th>Weight (kg)</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0.5</td>
<td>-1</td>
</tr>
<tr>
<td>8</td>
<td>1.9</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0.7</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4: Model algorithms’ accuracy for adult dogs

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Tested</th>
<th>Accuracy Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support Vector Machine</td>
<td>50%</td>
<td>60%</td>
</tr>
</tbody>
</table>

References:

[1] Algothim
[4] Logistic Regression
[5] Accuracy
[6] %
[7] %
[8] %
Table 5: Model algorithms’ accuracy for puppy dogs

<table>
<thead>
<tr>
<th>Algorithm Tested</th>
<th>Support Vector Machine</th>
<th>Fully Connected Deep Network</th>
<th>Logistic Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy Level</td>
<td>55 %</td>
<td>90 %</td>
<td>45 %</td>
</tr>
</tbody>
</table>

V. CONCLUSION AND FUTURE WORK

The research was done in one year of a period, limited time limits the research area and stop the research to go wider range. Sri Lanka is a country with different language-speaking people living together, in order to make the system user-friendly can add Sinhala and Tamil language instructions and make it optional for users to choose. Use a motion sensor that can detect and calculate the footstep of the dogs and use the information for the exercise and nutrition generating plan in the future.

Implement a bot that can maintain the auto channeling and doctor’s appointment booking. Spreading disease detection system using the tracking system. If the same disease is spreading in a specific location, it can be identified and notified to the users and doctors. Enhance the system by adding different pets into the system-version control with error detection to continuously maintain the app.

The application has a weakness of having less data collection; in the future, there is a possibility to come with more accurate results. Advance development of the human environment makes them need to get accurate information in less time. Having more research teams in these sections can improve applications to stand independently and act without human interference.

VI. ACKNOWLEDGEMENT

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Dimension of climate variability in the socio-economic sectors in Niger

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Abstract- The objective of this study is to analyze the dimension of climate variability in the main socio-economic sectors in Niger (agriculture, livestock, transport, health). The climatic situation since 1992 is characterized by a sudden alternation between very wet and very dry years, rather than an alternation of wet (1950-1969) or dry periods (1970-1991). The number of people affected has been steadily increasing, rising from 24,234 in 2013 to more than 430,000 in 2020. The damaged crop areas have increased fivefold while the number of decimated livestock has increased eightfold between 2012 and 2018. Transport infrastructure, particularly bridges, most of which were built in the 1970s and 1990s, i.e. during the periods of rainfall deficits, no longer respond to current climatic conditions (intense rainfall, increasing gullying, reactivation of dead valleys, rising water tables, etc.).

Keywords: Climate variability, Droughts, Floods, Republic of Niger.

I. Introduction

Africa in general, and the Sahel in particular, are among the areas most exposed to the effects of climate change. Floods, droughts, deforestation (Arthur et al. 2006, Jubek et al. 2019) and the drying up of lake areas and their impacts on the lives of millions of people are just a few examples of the impact of climate change on human lives and activities.

Niger has a Sahelian-type climate characterized by high interannual variability in rainfall resulting in increasingly frequent dry and wet years. This situation is linked to the nature of the climate and climate change, whose extreme adverse events are hampering the country's development. Indeed, since the major droughts of the 1970s and 1980s, Niger has faced an accelerated degradation of its environment. That degradation has caused not only the reduction and decline of the productive potential of the "natural resource capital", but also the disarticulation of the centuries-old systems of production and management of natural environments. The fragility of the country's ecosystems makes it very vulnerable to these phenomena, not to mention the fact that the difficult socio-economic context also weakens the adaptive capacities of the populations. In addition, the population census of 2012 indicates a rapid increase in population (227,523,850 hibts in 2020) with a growth rate of 3.9% per year.

In the Sahel, a highly vulnerable ecological environment, the climate has a significant influence on the socio-economic sectors such as agriculture, livestock, transport and health. In Niger, more than 80% of the agro-pastoral activities are carried out between the 100 mm and 500 mm isohyets, i.e. between the Saharo-Sahelian bands.
The soils of its environments are very sensitive to erosions (wind, water and chemical). Rain and river floods are also common, especially along the Niger River bed, valleys and ponds. We can remember the floods in Niamey in 2012, 2020 and those of the Goulbi in Maradi in July 2020. The agropastoral vulnerability of the climate is exacerbated by traditional practices, poverty or even the passivity of farmers and inefficient development plans.

The health and transport systems are developing, but they depend highly on external or private support. In the face of these inadequacies of the means of intervention and the quality of service, the country is continually affected by climatic phenomena (flooding, climate-sensitive diseases, and drought).

The transport infrastructure, particularly bridges, most of which were built between 1970 and 1990, i.e., during the periods of rainfall deficits, no longer meet current conditions (intense rainfall, increasing gullying, reactivation of dead valleys, rising water tables, etc.).

II. Methodology

Data sources
This study is based, on the one hand, on an analysis of statistical data and, on the other hand, on an analysis of documentary data from the relevant services (CNEDD, INRAN, and AGHRYMET) and the Ministries concerned (agriculture, environment, livestock, transport, hydraulics, health). They concern the elements of the climate, including temperatures and rainfall as well as sectoral production. Data and assessments of major floods and droughts are analyzed.

Materials
These are:
- data extraction and processing software: GeoCLIM, Excel;
- Field equipment including:
  - one (01) Garmin GPS for the recording of geographic coordinates;
  - one (01) digital camera for taking photos in the field.

III. Results

It is important to first clarify the nuance between the terms climate "change" and "variability". Variability refers to natural fluctuations in climate, including average states and extreme events. Climate is naturally in constant evolution. Climate change occurs when standard variations (patterns of climate variability and mean values) undergo significant measurable changes over the long term.

In the glossary of the IPCC (Intergovernmental Panel on Climate Change, 2013), the United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as “changes that are attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that are additional to natural climate variability observed over comparable time periods”. The UNFCCC thus distinguishes between climate change due to human activities altering the composition of the atmosphere and climate variability due to natural causes.
The rainfall evolution in the Sahel is characterized by two distinct periods:
- The period 1950-1969 was marked by a succession of wet years and the period 1970-1991 by a persistence of dry years. The end or not of the drought in the Sahel is currently the subject of debate within the scientific community. Some analyses conclude on the end of the phenomenon while others insist on its continuity.
- The situation from 1970 to 1991: To determine the wet or dry character of the rainy season, the standardized rainfall index (SPI) is commonly used. For a given year, this index averages the seasonal rainfall totals of the available rainfall stations. Thus, the SPI indicates whether the season can be described as surplus (if positive) or deficit (if negative).

Analysis of the Sahelian SPI, calculated on the basis of data from 600 stations monitored by the AGRHYMET Regional Center (2010), highlights two distinct periods (Fig., blue and pink parts). The first, from 1950 to 1969, is characterized by a persistence of wet years and the second, from 1970 to 1991, by a persistence of more than twenty dry years. The 1970s thus mark what is commonly called the climatic rupture in the Sahel. Such rainfall behavior has not been observed in any other region of the world. This analysis constitutes a consensus within the scientific community. Numerous international programs have studied the rainfall in the region in an attempt to explain the phenomenon, the latest and most ambitious being the AMMA program (Multidisciplinary Analysis of the African Monsoon). The drought observed in the Sahel during the period 1970-1991 also had no equivalent in its spatial dimension: it affected the entire region without exception.

The situation from 1992 onwards is characterized by a brutal alternation between very wet and very dry years, rather than a dry or wet period, an allusion to the situation before. Inter-annual variability has increased with the new mode of variability, making interannual rainfall forecasting in the Sahel even more difficult.

![Rainfall Index (RPI) of the Sahel over the period 1950-2019](source: Climatic data AGRHYMET 2019)

Positive values indicate years of above-average rainfall over the period 1950-2019 and negative values indicate years of below-average rainfall.

In 2012, Agadez, a city in the far north, has the heaviest toll with 60,555 victims, deplores the UN agency. Last week the authorities of Agadez said that the bad weather had already caused 16 deaths, including 7 in the city of Agadez alone, classified by UNESCO as a World Heritage Site.

Among the other hard hit regions are Maradi (center-south) with 34,877 victims, Zinder (center-east) with 13,601 victims and Diffa (south-east, very arid) with 10,992 victims, according to the UN report.

In 2017, the heaviest toll was recorded in the capital with 21 dead and 10 injured, in Maradi (9 dead and 26 injured) and in Tillabéri and Zinder (8 dead each). In Agadez (north), at the gates of the desert, there were 19,726 victims.

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According to Ocha, 9,267 houses and 31 schools collapsed and 16,048 head of cattle perished throughout the country. In addition, 709 wells were buried and more than 84 tons of grain and 9,804 hectares of fields and gardens were destroyed, again according to the UN agency.

In 2018, the regions "most impacted" by the bad weather are Maradi (center-south), Diffa (south-east), Zinder (center-east), Tahoua (west). Some 2,000-homeless people have been identified in the capital, Niamey.

In 2020, it is mostly the capital Niamey, especially the right bank of the river, which was affected by floods making more than 49,000 victims. In the region of Maradi, there were a total of 136000 victims (OCHA 2020).

![Graph showing disaster victims, collapsed houses, hectares of damaged crops, and the dead from 2012 to 2020.]

**Fig. 3: Summary assessment of the floods in Niger (2012-2020)**

Source: statistics of OCHA

In sum, the number of people affected is constantly increasing from 24, 234 in 2013 to more than 430, 000 in 2020 (OCHA 2020). The area of the damaged crops has increased fivefold while the number of decimated livestock increased eightfold between 2012 (3,118) and 2018 (2,6344).

### 3.1 Agriculture and climate variability

Agriculture in Niger is essentially rainfed and dominated by cereals (millet, sorghum, maize, rice) and cash crops (cowpea, groundnut, voandzou, sesame, sorrel, souchet, cotton). Under irrigation, Niger also produces rice in hydro-agricultural developments and vegetable crops, mainly onions. The potential for arable land is estimated at 15 million hectares, of which only 270,000 hectares are irrigable.

Climate variability affects all dimensions of food security for vulnerable groups (Alessandra et al. 2016, Alexis et al. 2017). According to the definition adopted at the World Food Summit in Rome in 1996: Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

85% of Niger's cultivable soils are dune, not very productive, fragile and very sensitive to water and wind erosion. Peasant farming practices are characterized by a low level of intensification and remain largely manual. Yields are low and highly fluctuating. The low level of fertilization, the reduction of fallow land and the extension of cropland by clearing marginal land encourage the development of water and wind erosion and no longer ensure the reproduction of soil fertility.

Agriculture is essentially rainfed and therefore based on the rainfall regime of the country. On the basis of rainfall, four agro-climatic zones can be distinguished:

- the Sahel-Sudanian zone, which represents about 1% of the total area of the country and receives 600 to 800 mm of rain per year in normal years;
- the Sahelian zone covers 10% of the country and receives 500 to 600 mm of rainfall;
- the Sahelo-Saharan zone which represents 12% of the country's surface area (150 to 350 mm/year);
- the Saharan desert zone, which covers 77% of the country (less than 150 mm/year) (CNEDD, 2011).
Yields are constantly decreasing substantially due to deteriorating weather conditions. Over the last 20 years, a decline of around 30% has been observed, reflecting the decline in soil fertility, one of the major problems of agriculture in Niger (CNEDD, 2011). This situation is at the root of the production deficit recorded almost one year out of three (between 200,000 and 300,000 tons), thus causing a decrease in food self-sufficiency and forcing significant food imports.

From the 1970s to 2011, it was mainly droughts that caused major crop or yield losses. Niger experiences regular droughts (Alpha 1993, CNEDD 2011), causing serious famines that recur every ten years like those of:

- 1855: great spontaneous famine caused by droughts
- 1870 great famine caused by droughts
- 1900-1901: Great famine caused by droughts that led to an unprecedented exodus of rural people to large cities and coastal countries;
- 1910 to 1917 with rainfall deficits of 135 to 377 mm leading to a total absence of grain in the markets;
- 1923-1924 having mainly affected livestock with generalized fodder deficits;
- 1930-1931: Exceptional drought and locust invasion;
- 1944: famine in northwestern Niger due to a rainfall deficit;
- 1966-1967 famine that gave the name of Bandabari to a district of Niamey created spontaneously by the populations of the affected regions who found refuge in the capital.
- 1972-1975 with a drastic drop in food production which reached 400,000 tons in 1973;
- 1983-1985, with the great drought following the deterioration of climatic conditions;
- 1990-1994, during which food difficulties were recorded;
- 1996-1997, having recorded a rainfall deficit;
- 2001, Niger experienced a particularly acute food crisis in several regions;
- 2004-2005, the food crisis was linked mainly to the locust invasion, cereal deficits, and difficulties in accessing markets for the poorest people. A total of 3,500,000 people were food insecure (29% of the country's total population);
- 2008, about 30% of the Nigerien population was food insecure, including 9% in severe insecurity. In other words, nearly 6 out of 10 agricultural households could not cover their food needs for more than three months out of twelve and more than 20% of households had a qualitatively poor diet;
- 2010, following a cereal deficit related to a poor distribution of rainfall in time and space during the 2009 rainy season;
- 2011 another food crisis affects 7.1 million people, or 48% of the population. That new crisis confirms a structural problem related to the insufficient implementation of agricultural policies, or even their inadequacy (Yayé et al. 2010, Ministry of Agriculture 2017).

It should be noted that since 2012, there are more and more agricultural losses caused by floods. The impact of climate variability on agriculture is not only reflected in reduced yields. In addition to climatic manifestations (irregular distribution in time and space of low rainfall, sometimes heavy rains causing flooding or land erosion, and manifestations of high temperatures that lead to scalding of ears before maturation), this impact is also manifested by a transformation of cropping systems (Lona, 2011) resulting in:

- the modification of the entire agricultural calendar: soil preparation is neglected because the urgency is now given to sowing; crop establishment tends to take place at the same time for millet, sorghum and cowpea as soon as the first rains come, whereas cowpea is usually sown after the first weeding of millet.
- Weeding is less numerous and faster (weed pressure is lower) due to the shortening of the rainy season;
- the abandonment of traditional rice cultivation due to the insufficient flooding of the river, aggravating the food insecurity of the population;
- the drastic reduction of the areas allocated to flooded rice in favor of rice in individual pumping systems and hydro-agricultural developments,
- the abandonment of groundnut cultivation because of the importance given by farmers to cereals since the various food crises that have followed one another;
- the abandonment of cotton grown particularly along the riverbank in favor of rice and tobacco cultivation since the Bandabari famine (1966) and the 1973 drought;
- the abandonment of flood recession sorghum cultivation following the low floods and severe low water levels recorded since the early 1970s and the late millet variety Sommo,
- The extension of the sorghum cultivated areas: Sorghum that was cultivated around the river (flood recession sorghum) has experienced a considerable rise towards the plateaus. Thus, with the advent of other varieties, the crop first gained ground in the lowlands (edges of ponds and marigots, etc.), then in the glacis with the advent of the plough, and now even on dune soils;
- the extension of the cultivation of cucurbits (Cucurbita maxima, Citrullus lanatus and Lagenaria siceraria): this crop, which was specific to the river area, is nowadays found in the bed of dry ponds,
- the generalization of the cowpea cultivation, drought resistant and fodder plant ;
- the fragmentation of family land holdings due to demographic pressure;
the reduction or even disappearance of fallow land, which indicates a land blockage at the household and land levels and poses the problem of soil fertility management;

the increase in the frequency of poor harvests: The phenomenon has even become chronic in recent years to such an extent that some farmers say: "there are only deficit years in their land".

the modification of the location of optimal growing areas due to the shift in isohyets: the case of the modification of West African cotton growing areas, with the disappearance of the cotton zone in Niger.

Recent studies have already shown that yields of crops such as millet/sorghum will decrease by more than 10% in the case of a temperature increase of +2°C and insignificant variations in rainfall by 2050. An increase of +3°C will lead to a decrease in agricultural yields of about 15 to 25%. (Sarr et al. 2007; AGRHYMET, 2009).

3.2 Livestock and climate variability

This section looks at the consequences of climate change on the size of the livestock in Niger on the one hand, and the fodder balance sheet on the other. With a livestock estimated at nearly 41 million heads or 15,829,818 TBU in 2014 all species combined and for a total value of more than 3,000 billion CFA francs, Niger is a breeding country par excellence (Ministry of Agriculture 2017). Livestock farming is credited with a 15% contribution to the national GDP and contributes 42.29% to the formation of the agricultural GDP. The livestock sub-sector also constitutes the country's second largest export revenue (23.7% of the total value of exports) after uranium (62.76%). With respect to food security and the fight against poverty, the contribution of livestock farming is on average 15% of household income and 25% to meeting food needs. (Ministry of Agriculture 2017). Apart from droughts, as was the case for agriculture, floods mainly impact herds in depressions, on the edges of valleys and ponds. Livestock farming is therefore confronted with climatic variability for which it is called upon to suffer the consequences (see following figures).

Table 1: Animal losses caused by climatic hazards (drought and floods)

<table>
<thead>
<tr>
<th>Period</th>
<th>Causes</th>
<th>Cattle</th>
<th>Sheep</th>
<th>Goats</th>
<th>Dromedaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>1973-1974</td>
<td>Generalized drought</td>
<td>45%</td>
<td>27%</td>
<td>15%</td>
<td>-</td>
</tr>
<tr>
<td>1984-1985</td>
<td>Generalized drought</td>
<td>40%</td>
<td>35%</td>
<td>33%</td>
<td>-</td>
</tr>
<tr>
<td>2004-2005</td>
<td>Drought and acridian invasions</td>
<td>20%</td>
<td>16%</td>
<td>13%</td>
<td>-</td>
</tr>
<tr>
<td>2009-2010</td>
<td>Drought and acridian invasions</td>
<td>25.5%</td>
<td>38.6%</td>
<td>31.3%</td>
<td>2.6%</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture 2017

Table 2: death rate per flood/ heavy rain in accordance with species and counties

<table>
<thead>
<tr>
<th>species</th>
<th>cattle</th>
<th>sheep</th>
<th>goats</th>
<th>camels</th>
<th>horses/donkeys</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tchirozérine</td>
<td>28 060</td>
<td>115 189</td>
<td>13 546</td>
<td>46</td>
<td>7008</td>
<td>163 849</td>
</tr>
<tr>
<td>Mainé-Soroa</td>
<td>1 153</td>
<td>1821</td>
<td>1354</td>
<td>0</td>
<td>20</td>
<td>4348</td>
</tr>
<tr>
<td>Dogondoutchi</td>
<td>4004</td>
<td>6635</td>
<td>5847</td>
<td>0</td>
<td>2</td>
<td>16488</td>
</tr>
<tr>
<td>Dakoro</td>
<td>6048</td>
<td>27569</td>
<td>0</td>
<td>34</td>
<td>1500</td>
<td>35151</td>
</tr>
<tr>
<td>Abalak</td>
<td>6756</td>
<td>11898</td>
<td>11815</td>
<td>37</td>
<td>898</td>
<td>31 404</td>
</tr>
<tr>
<td>Tchintabaraden</td>
<td>1213</td>
<td>5208</td>
<td>0</td>
<td>107</td>
<td>325</td>
<td>6 853</td>
</tr>
<tr>
<td>Tillabéri</td>
<td>5800</td>
<td>6 450</td>
<td>13600</td>
<td>210</td>
<td>635</td>
<td>26 695</td>
</tr>
<tr>
<td>Filingué</td>
<td>1156</td>
<td>1 520</td>
<td>1076</td>
<td>0</td>
<td>0</td>
<td>3 752</td>
</tr>
<tr>
<td>Ouallam</td>
<td>558</td>
<td>8 173</td>
<td>570</td>
<td>38</td>
<td>171</td>
<td>9 510</td>
</tr>
<tr>
<td>Téra</td>
<td>22</td>
<td>173</td>
<td>139</td>
<td>0</td>
<td>0</td>
<td>334</td>
</tr>
<tr>
<td>Gouré</td>
<td>9999</td>
<td>25 859</td>
<td>1316</td>
<td>273</td>
<td>336</td>
<td>37 783</td>
</tr>
<tr>
<td>Tanout</td>
<td>947</td>
<td>5 614</td>
<td>230</td>
<td>7</td>
<td>371</td>
<td>7 169</td>
</tr>
<tr>
<td>Total</td>
<td>65716</td>
<td>216 109</td>
<td>49493</td>
<td>752</td>
<td>11266</td>
<td>343 336</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture 2017

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From 1973 to 2020, Niger experienced enormous livestock losses due to droughts and floods. As for the fodder deficit, it led to the loss of 2,725,427 head of livestock of all species, or 13.51% of the total livestock population of the regions concerned (Ministry of Agriculture 2017). The loss of herds caught by runoff in depressions, valleys and around ponds. For example, in Kongou, a village located 10 Kongou Northeast of Niamey, the valley took 275 head of cattle, a loss due to the overflow of the valley after the heavy rains of the first week of September 2020.

3.3 Transportation and Climate Variability

The impacts of climate variability on road infrastructure are generally due to extreme conditions (heavy rains, river overflows, high winds and high temperatures). These conditions have an impact on the various factors during the operation of a road or engineering structure. Most of these factors have a direct or indirect impact on society, the economy, safety (driver, vehicle), traffic and accessibility:

- safety: these weather conditions have a negative impact on safety because they influence the risk of accidents. For example a road can be cut by a flood (RN 1 in Binin' Gaouré August 2020), rain and wind reduce visibility, grip and control of the vehicle. Extreme temperatures increase the temperature of the roadway which leads to the bursting of the wheels and decreases the comfort of passengers;
- traffic: Road users tend to adapt their speed to outside conditions, resulting in lower speeds. Traffic can also be influenced by road conditions, as a very marked deterioration of the road infrastructure slows down, prevents and impedes traffic. Large carriers take time to deliver goods, which impacts the trade circuit, thus the economy and causes loss of life and property;
- Accessibility: weather conditions lead to a decrease in the accessibility of a network and the surrounding regions. In the region of Agadez, the cuts, on the axis of the RN1 ZINDER-AGADEZ-ARLIT PK 379 (50km from Agadez), are due to the displacement of sand dunes which are mainly caused by strong winds raising dust and sand. These hot and dry winds blow in March and April and the intervention is done every 48 hours after their passage which can last more than a week. The increase in rainfall due to climate variability and change observed during the last decade throughout the country has led to the reactivation and silting of all the ancient koris, particularly in the region of Agadez and poses traffic difficulties. In addition, the structures in that region are subject to high temperatures during the day and low temperatures at night. These extreme temperature variations lead to abrasion and cracking of the materials of the structures (crumbling of the concrete of the structures, volatility of the tar, degrades their resistance and shortens their lifespan).

In the region of Diffa too, it is the silting due to strong winds and extreme temperatures that cause road cuts and damage to the structures. In 2016, the regional directorate of equipment of Diffa carried out twenty (28) road de-silting operations that total 8004 m3 of sand cleared, equivalent to 667 trucks of 12 m3 (Republique du Niger 2017).

In September 2018, at the Benin-Niger border (Malanville) after the collapse of a bridge, 732 trucks were immobilized. Detours to Nigeria and Burkina Faso were necessary to establish road traffic, especially goods traffic to Niger. Some passengers used canoes at the collapsed bridge.

There are a multitude of bridges such as the one at Bangawi 40 km west of Niamey on the National Road N°1 whose pillars gave way following heavy rains and that information is only known by the people who use these roads. At the eastern exit of Niamey (Route Filingué), the tar passing over a lowland was impassable for three weeks. Each year of excess rainfall brings a destruction of the roads, especially the bridges.

3.4 Health and climate variability

In Niger, the impacts of climate variability on health mainly concern climate-sensitive diseases such as malaria, meningitis and measles. Indeed, droughts, combined with high temperatures, accentuates the spread of certain diseases such as meningitis (Garcia et al. 2014; Prudence et al. 2019), while heavy rains and floods promote the proliferation of certain endemic diseases, the most dangerous of which is malaria.

Sand and/or dust storms, combined with the extremes of certain climatic variables such as temperature and relative humidity, considerably accentuate certain respiratory diseases and cause eye irritation. They may also be associated with the spread of meningitis.

On the nutritional level, a drought results in localized food shortages and famine, which are certainly the causes of malnutrition and fragility of certain vulnerable groups, namely pregnant and nursing women and children.

Meningococcal meningitis is found throughout the world, but it is in the meningitis belt, which extends in sub-Saharan Africa from Senegal in the west to Ethiopia in the east, that the burden of the disease is the highest. Tens of thousands of cases are still reported each year in that area (Ayansina et al. 2020), the true numbers are never known because in rural areas, most patients do not attend medical centers.

During the dry season, between December and June, dust-laden winds and upper respiratory tract infections combine to damage the nasopharyngeal mucosa, increasing the risk of meningococcal disease.
Meningitis, which used to occur from April onwards due to the high temperatures, now appears even in October, January, February and March because of the climatic variability, the daily maxima due to the Harmattan (hot and dry trade winds) are around 40°C in those months. In 2015, between January and June there were 573 deaths out of a total of 8500 cases.

Meningococcal meningitis appears even in October as soon as temperatures reach 40 degrees as it was the case in 2017. That is mainly due to too short rainy seasons with rainfall stopping before September 30 or very low rainfall in October not exceeding 5 mm. In many clinics, especially private ones, meningitis during its first days of occurrence is treated like malaria because some of its symptoms (fever) resemble it.

IV. Discussion - Conclusion

All the regions of Niger are affected by flooding following heavy rains, especially those of 2020. On the agricultural level, it is to be retained:
- a change in the location of farming areas;
- a decrease in agricultural yields;
- a change in the types of pests and diseases;
- a food deficit leading to famine or permanent food insecurity;
- a rural exodus leading to the creation in urban areas of communities exposed to delinquency, prostitution, begging, theft and banditry;
- a decrease in the contribution of agriculture to the GDP.

In short, for the livestock sector we retain:
- the decline in rural incomes;
- the profound changes in the composition of herds through a gradual replacement of cattle by small ruminants;
- the malnutrition of the animal population;
- the conversion of a large number of nomadic breeders to sedentary ones;
- the imbalance in the balance of trade, thus a reduction in the contribution of livestock to GDP.

The aid and relief to the disaster victims is summarized in food and health assistance (cereals, soap, oil, mosquito nets). Each rainy season brings its corollaries (floods, drought, locust and granivorous bird invasion, phytosanitary damage, etc.). Other impacts (damaged road infrastructure, buried wells, tons of cereals washed away, destroyed gardens) remain invaluable most years.

In the future, the roads and bridges of the fossil valleys will be very exposed as flooding (Armel et al 2013), heavy rains and gullying will intensify (Inoussa et al. 2019, Francesco et al 2020, Augustin et al. 2020). Funds for emergency response and adaptation/mitigation plans are based more on assistance (waiting for external aid) than on the state's own means. That is demonstrated every time there is a disaster such as the floods of September 2020 for which a mobilization meeting is calling for 97.3% of the 372 billion CFA (US$660 million) from partners. The disaster victims are always rehoused in schools during the first weeks of the disasters.

Among these activities is the development and dissemination to decision-makers of new products and tools to improve the practice of climate-smart agriculture (CSA). CSA is an approach that identifies the actions needed to transform and reorient agricultural systems to support sustainable development and ensure food security in the context of a changing climate (FAO, 2010). It helps to ensure food security, achieve climate change adaptation and mitigation goals, and reduce poverty.

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Studies on the levels of some heavy metals in vegetables grown in three irrigation zones of Katsina state, Nigeria

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Abstract- Levels of Cd, Cr, Cu, Fe and Pb in some vegetables irrigated in three irrigation zones of Katsina State have been studied using Atomic Absorption Spectrometry. Results revealed that Cd was not detected in any of the samples analysed while other metals were present at varying levels. Fe and Pb were found to be present in all the samples with levels above WHO/FAO recommended MPL for the metals. Highest values were obtained in Kofar Marusa irrigation area. It was thus concluded that the high levels of the metals in that area was due to the fact that sewage water containing a lot of heavy metal contaminants was used for the irrigation. It was further concluded that the consumption of vegetables irrigated in that area may pose health threats to the consumers. Thus, it was recommended among others, that ban should be imposed on the use of sewage water for irrigation purpose.

Index Terms- Heavy metals, vegetables, Irrigation, pollution

I. INTRODUCTION

Vegetables is a class of foodstuffs that make an important component of human diet and which provide good sources of vitamins, minerals and fibres, and provide effective antioxidant effects in the human body. However, if vegetables are contaminated with heavy metals, their intake may pose serious health risks to the human body. Prolonged consumption of heavy metal polluted vegetables may lead to chronic accumulation of heavy metals in the body organs such as liver, kidney and lungs causing disruption of numerous biochemical processes, leading to cardiovascular, nervous, kidney, bone and other body diseases [1, 2]. Heavy metals are those metals that fall within the d – block of the periodic table and whose atomic numbers are greater than 20 with specific gravity of 5 gcm-3[3].

Heavy metals may be categorized into two groups, essential and non-essential based on the role they play in living systems. Metals like Manganese (Mn), Iron (Fe), Nickle (Ni), Zinc (Zn) and Copper (Co) enhances the growth, development and physiological functions of living organism and are therefore classified as essential heavy metals while elements such as Cadmium (Cd), Lead (Pb), Mercury (Hg) and Arsenic (As) do not enhance physiological activities in living Systems and are therefore classified as non-essential heavy metals [4].

Long exposures of heavy metals by ingestion, dermal contact could lead to chronic health affect in living organisms, or Animals including human could be exposed indirectly via food chain transfer. The metal might be available in plant at varying concentration in the shoot of plants. Even though the concentration depends on season and its bioavailability in the soil [5]. The continuous anthropogenic activity called for collection of data on heavy metals pollution. Considering the limited information available in northern Nigeria on the subject [5]. Thus, updating on the level of heavy metal concentration particularly Katsina state is crucial.

Heavy metals are non-biodegradable and remains in the environment as persistent environmental contaminants which enters into the environment through natural and anthropogenic processes where they may be deposited on the surfaces and then absorbed into the tissues of vegetables and other plants by absorption from contaminated Soils [6,7,9,10 &11].

Heavy metals are toxic due to their non-biodegradable nature, they exert their toxic effect by one of two Primary mechanisms: They Either substitute for metals required by the body and effectively act as an antagonist to the essential metal, or they may directly cause damage to the tissue (direct irritation). The toxicity of heavy metals has for a long time been a global challenge. For instance, the Minamata disease [13], the pink disease [14], the Bradford sweet poisoning [15, 16], the itai-itai disease [17], the Iraq mercury poisoning [18], the Alexander Litvinenko poisoning [19] and the Zamfara lead poisoning [20, 21& 23]; are all cases of catastrophic and endemic heavy metal poisoning resulting from human exposures to the heavy metals recorded in history at different times and places.

The use of Sewage water for irrigation is a common practice in urban and sub-urban centers in Nigeria. The Sewage water often contain heavy metals in various forms and at different contamination levels. Thus, vegetables produced from irrigation with contaminated (Sewage) water may be contaminated with heavy metals [24]. Several studies have shown that heavy metals are important contaminants of vegetables [9, 10, 11, 12, 24, 25, 26 & 27]. The vegetable grown could be contaminated by agricultural waste and other organic matter in the catchment area of rivers into agricultural reservoir particularly during the raining season [28]. Water degradation has been noticed in Zobe
reservoir, as effluents flows into the water body during the rainy season. And the fact that Zobe dam serves many purposes including cattle watering, and public water source and fish culture, irrigation farming especially vegetables [28]. Thus, if contamination occur such vegetables could be affected as well. Even though, the concentrations of heavy metal in plants vary with plant species [29]. Research revealed that 60–80% of heavy metal toxins detected in human bodies living in urban areas were due to the consumption of contaminated foods. And not via air pollution [30] at long run will have impact on human health. In addition to limited information on heavy metal concentration in vegetables grown in the areas. Against this background, the present study focuses attention on the comparison of heavy metal pollution of some vegetables irrigated in three irrigation Zones of Katsina State using different water bodies.

II. MATERIALS AND METHODS

**Study areas:** The study compared the levels of some heavy metals (Cd, Cr, Cu, Fe and Pb) in carrot, lettuce and pepper grown in three irrigation sites; Kofar Marusa irrigation (KMI) area Katsina town with coordinates 12°59’19.1’’N; 7°36’.33.2’’E, Zobe dam irrigation (ZDI) area, Dutsin-ma located at coordinates Latitude 12°19’ 34.52’’N to 12°24 27.28’’N and between longitude 7°26’.57.11’’E to 7°34’.47.48’’E and Mairuwa dam irrigation (MDI) area, Funtua situated at coordinates latitude 11°58’.76.51’’N to 11°35’.11.30’’N and longitude 7°23’.81.19’’E to 7°14’.14.41’’E (Figure 1).

**Sample Collection and Treatment:** On 1st November 2019, samples of the three vegetables (Carrot tuber, Lettuce leaves and Pepper fruits) were collected from the three irrigation zones. The samples were dried under the shade and ground into powdered form and kept ready for metal analysis with the Atomic Absorption Spectrometer (model, AA280FF, manufacturer USA). This process was done on quarterly basis and the mean values of metal levels were determined and used for comparison.

**Sample digestion for metal analysis:** The powdered sample in 0.2g each was weighed into a conical flask using an analytical standard electronic balance. A volume of 2cm³ conc. HNO₃ was added to each sample in the Conical flask. The flask was placed on a hot plate and heated at 110°C for 30 min. and then 150°C for 2hrs. the Conical flask was then removed and allowed to cool to room temperature. The digested sample was then filtered into 100cm³ standard volumetric flask while the Conical flask was rinsed three times with deionized distilled water and the rinsing were added to the volumetric flask. This solution was then diluted to the 100cm³ mark of the volumetric flask using deionized distilled water and was thoroughly mixed and keiptin the laboratory ready for AAS analysis.

**Table 1: Recommended concentration of heavy metals in soil and plant**

<table>
<thead>
<tr>
<th>Heavy metals</th>
<th>Recommended limit in soil</th>
<th>Recommended limit in plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cd</td>
<td>3.00 (WHO)³²</td>
<td>0.10 (WHO)³²</td>
</tr>
<tr>
<td></td>
<td>0.50 (EU)³²</td>
<td></td>
</tr>
<tr>
<td>Cr</td>
<td>0.05 (WHO)⁵</td>
<td>0.10–0.50 (WHO)⁶</td>
</tr>
<tr>
<td>Cu</td>
<td>100.00 (WHO)³²</td>
<td>1.30 (WHO)⁵⁵</td>
</tr>
<tr>
<td>Pb</td>
<td>300.00 (WHO)³²</td>
<td>100.00 (WHO)³²</td>
</tr>
<tr>
<td>Fe</td>
<td>5000.00 (WHO)³²</td>
<td>425.00 (WHO)³²</td>
</tr>
</tbody>
</table>

The recommended concentration (mg/Kg) limit of heavy metals in (Agricultural) soil and plants according to WHO (World Health

Figure 1: The map of Katsina state that covers the sampling areas as depicted in blue colored star (Zobe dam irrigation area), red star (Kofar Marusa irrigation area) and white star (Mairuwa dam irrigation area) [31].
The results obtained are presented in tables and charts as follows; The Table shows that Cd was not detected in any of the vegetables analyzed in all the three irrigation zones. This may be due to the fact that in all the areas under study, no activity takes place that leads to the release of Cadmium such as Coal combustion, Iron and Steel production, phosphate fertilizer manufacture and use, Zinc production, mining, smelting, plating etc. Cr was not detected in carrot from Kofar Marusa and in lettuce and pepper from MDI (Mairua dam irrigation) area. However, it is present in lettuce and pepper of Kofar Marusa and carrot, lettuce and pepper of ZDI (Zobe dam irrigation) area as well as in only the carrot of MDI area. Simply, copper was not detected in all the vegetable samples from KMI area but was found present in all the samples of carrot, lettuce and pepper irrigated in both ZDI and MDI areas.

The Table 2 further shows that Fe and Pb were present in all the samples from the three irrigation areas at levels that are alarming especially Pb whose levels were all above the WHO/FAO guidelines set by the organizations for human consumption. High levels of Pb were observed in samples obtained from KMI, this may not be unconnected with the sources of the water used for irrigation in that area which is the run-off from the metropolitan Sewage which contains a lot of wastewater from battery charging sites.

This result is consistent with the results of [34] on the study of heavy metals in vegetables and their impact on the nutrient quality of vegetables in which levels of some heavy metals (Pb and Cd) were found to exceed the FAO/WHO MPL for the metals. The results were also in agreement with those of [25] in the assessment of heavy metals in wastewater Irrigated lettuce in Ghana where it was observed that levels of metals studied were lower than the WHO/FAO recommended levels for the metals.

### Table 2: Mean levels of Cd, Cr, Cu, Fe and Pb in carrot, lettuce and pepper

<table>
<thead>
<tr>
<th>Location</th>
<th>Sample</th>
<th>Metal</th>
<th>Mean (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KMI</td>
<td>Carrot</td>
<td>Cd</td>
<td>(0.10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr</td>
<td>(0.10–0.50)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cu</td>
<td>(5.10–30.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe</td>
<td>(425.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pb</td>
<td>(0.30)</td>
</tr>
<tr>
<td>ZDI</td>
<td>Carrot</td>
<td>Cd</td>
<td>(0.10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr</td>
<td>(0.10–0.50)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cu</td>
<td>(5.10–30.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe</td>
<td>(425.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pb</td>
<td>(0.30)</td>
</tr>
<tr>
<td>MDI</td>
<td>Carrot</td>
<td>Cd</td>
<td>(0.10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cr</td>
<td>(0.10–0.50)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cu</td>
<td>(5.10–30.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fe</td>
<td>(425.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pb</td>
<td>(0.30)</td>
</tr>
</tbody>
</table>

The vegetables (Carrot, Lettuce and pepper) samples was collected in three replicates from each of the three different locations Kofar Marusa Irrigation Area (KMI), Zobe dam Irrigation Area (ZDI) and Mairua dam Irrigation Area (MDI) within Katsina state Nigeria while ND stand for not Detected. The value in bracket indicated the method detection limit (MDL), all the units were mg/Kg. The bolded values exceeded the World Health Organization (WHO) recommended heavy metal limit.

Mean concentration of heavy metals: The Figure 1 showed mean concentration in mg/kg of heavy metal across all locations in the order of Fe > Pb > Cr > Cu, while Cd has not been detected in the samples.

Heavy metal by locations: The mean concentration of heavy metal in KMI vegetable depicted Fe > Pb >Cr >Cu >Cd. Similar patterns were shown in the other two locations (ZDI and MDI), where Fe have highest concentration and Cd recorded the least concentration among the four heavy metal results within each location as shown in Figure 2. The heavy metal in all the location showed no statistically significant difference (P > 0.05) However, Cu showed significant difference (P < 0.05) The variations in patterns of metal concentration across sampling locations could be related to the intensity and duration of climatic variables such as precipitation, temperature as reported by [5]. The Fe was found to be a dominant metal when compared with other heavy metals in the study sites. Its concurred with the result from previous research on the study area [35]. Thus, signifying little or no change on the heavy metal composition in area. KMI area was observed to be linked with sewage mainly from anthropogenic activity such household effluents, fossil fuel combustion, vulcanization activities.
Heavy metal by vegetables and locations: The Figure 3 revealed mean concentration of Fe, Pb, Cr and Cu in relation to vegetation types as follows:

Fe: showed the order in vegetable as follows: KMI Lettuce > MDI Lettuce > ZDI Lettuce > MDI Pepper > KMI Carrot > KMI Pepper > ZDI Pepper > ZDI Carrot > ZDI Lettuce. Lettuce have the highest Fe concentration among the vegetable and locations. Whereas, carrot recorded the least Fe concentration in ZDI location.

Pb: mean concentration in vegetable were showed; KMI Lettuce > KMI Carrot > ZDI Pepper > MDI Carrot > KMI Pepper > MDI Lettuce > ZDI Carrot > MDI Pepper > ZDI Lettuce. Lettuce have the highest. Pb concentration in KMI as in Fe. However, lettuce located in ZDI showed the least Pb concentration. The Pb concentrations across the three locations were higher than threshold limit in plant of 0.30 mg/Kg as specified by WHO (Table 2). Higher level of Pb in Katsina has been ascribed to vehicular emissions due to heavy traffic density. The discharge of Pb into surrounding atmosphere and its subsequent deposition on soil and other objects [36], contributed to the high Pb concentration in vegetables found in the study area.

Cr: On the other hand, concentration appears in order KMI Pepper > ZDI Carrot > ZDI Lettuce > KMI Lettuce > MDI Carrot. The pepper has highest Cr concentration among the vegetable under study, carrot situated in MDI has the least Cr concentration. Concentration of Cr in all the vegetable sampled do not exceed the normal limit (0.10 to 0.50 mg/kg) except pepper in KMI. However, the concentration level recorded in pepper (1.385 mg/kg) was below the described phytotoxic level of 0.10 to 0.50 mg/kg [5].

Cu: MDI Lettuce > MDI Carrot > MDI Pepper > ZDI Carrot > KMI Lettuce and ZDI Pepper. Cu appear to be non-detected in KMI. This could be due to its low concentration in soil as lower than the maximum permissible limits was reported in the previous research conducted at Kofar Marusa area [35].

Cd: appears to be undetectable across the samples of the vegetable. The non-detection of Cd in the vegetable leaves analyzed confirm the previous research finding which revealed negligible Cd concentration in KMI soil [35]. The soil of urban Katsina were still recommended of WHO (0.10 mg/kg) [32].

Heavy metals in plant which exceed the recommended limit is toxic as it has inhibitory effects on enzymatic activity, stomatal function, photosynthesis and nutrient uptake. Thus, leading to chlorosis and stunted plant [5]. However, all the heavy metal detected is within the tolerable limit except Fe. Among the vegetable samples pepper showed significant difference (P < 0.05) in the Fe level of concentration. Whereas, other samples showed no significant difference (P > 0.05) in the level of heavy metal concentration.

IV. CONCLUSION

The vegetables in the study areas depicted Cr, Fe and Pb to be relatively higher in KMI area. And Fe is particularly higher across all the location. This could be ascribed to the use of sewage water by farmers for watering vegetables grown in the area. Furthermore, the consumption of vegetables irrigated in the area may constitute health hazards to the consumers. The recommendations proffered include among others; Proper treatment of sewage water before use for irrigational activities. Continuous monitoring on the levels of toxic metals in vegetables and soils and waters. And general public should be enlightened on the activities that leads to heavy metals pollution of the environment. Lastly, an alternative, relatively low cost and environmental friendliness ways of handling heavy contamination such as bioremediation using green technology could employed.

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Abstract- Watershed degradation is an example of natural resource degradation that affects environment and food security negatively. Integrated Land and Watershed Management Project in Kibuon and Tende catchments (ILWMKTP) ran from 2009 to 2014. The programme focused on reduction of degradation by using soil and water conservation practices. The survey was carried out in Kisii, Nyamira and Homa Bay Counties which were purposively selected since they implemented the project. The study was an ex post facto research design which used cross sectional survey approach that applied qualitative and quantitative data collection procedures. The survey targeted a population of 9,475 respondents who implemented ILWMKTP project while the accessible population was 370 farmers who were proportionately selected through simple random method. The survey used a questionnaire and an interview schedule to collect data from farmers and key informants. A research tool was used to gather data on attitude farmers’ in terms of practices used to control watershed degradation. Data analysis was done using SPSS version 25. There were significant differences in levels of positive attitude on watershed management practices. Responses captured were rated on a five point likert scale and frequencies were run for respondents who agreed on positive statements on the practices and their percentages were between fifty one and seventy one percent. This implied that respondents had different levels of positive attitude on watershed management practices in the catchments.

Index Terms- Attitude, watershed, practices and management

I. INTRODUCTION

Water and soil are key in economic development of any nation through agricultural production (Heiner, Shames & Spiegel, 2016). Globally, watershed degradation has become severe affecting more than 20 percent of agricultural land, 30 percent of forested and 10 percent of grassland. Affected areas range between 20 percent to 50 percent of land in Sub Saharan Africa inhabited by 200 million people (Tamene, IKindu, Woldearegay & Abera, 2014). Watershed degradation is the most serious natural resource degradation affecting environment and socio-economic factors (Atnafe, Ahmed & Adane, 2015). It threatens food security making watersheds prone to climate change variability including poverty (Mesfin, 2010; Ibido, 2015; Kieti, Kauti & Kisangau, 2016). Kibuon and Tende catchments are on Eastern side of Lake Victoria in South West Kenya and were characterized with degradation which contributed to less water base flow and enhanced poverty. Benefits of watershed management cannot be overstated, therefore Integrated Land and Watershed Management Project in the catchments was implemented from 2009 to 2014 to enhance land productivity and water base flow in the in the two rivers. The agricultural extension programme planning and implementation interventions used an Integrated Project Extension Approach in ILWMKTP to disseminate watershed management practices. The approach is the best for dissemination of soil and water conservation practices among smallholder farmers who are resource limited.

Literature Review

Global Degradation of Watersheds

Most developing countries in the world are keen on watershed management because of its negative effect on food security (Swallow, Onyango & Meinzen-dick, 2008). Watershed degradation and limited land resources have a negative impact on systems used in food production expected to feed a world population of 9 billion people by 2050 (Manuelli, Hofer, & Vita, 2014). Soil erosion contributes to watershed degradation which reflects in a decline in food productivity (Blinkov, Kostadinov & Marinov, 2013).

Degradation of Watersheds in the Tropics

Watershed degradation is an economic constraint that affects livelihoods in many nations. Its management in Ethiopia enhances effective use of natural and social capitals in the Country (Tiki, Kewessa & Wudneh, 2016). According to Mondal, Singh, Singh and Kumar, (2013), Indian watershed projects address protection of natural resources to increase production. Profitability is crucial in conservation of watersheds because benefits from some of the practices are not felt immediately (Darghouth et al., 2013).
2008). According to Mesfin, (2010) the decision to implement practice watershed management starts with accepting erosion as an issue since some of the structures take between 5-15 years before their effects are felt. Their uptake is determined by social and economic factors, and demographic factors (Ibido, 2015 & Adjaye, 2008).

Degradation of Watersheds in Kenya
Watershed degradation in Kenya is caused by high population, over-use of natural resources, climate variability and release of pollutants in the environment (GoK, 2014; Kieti, Kauti & Kisangau, 2016; Gunya, 2009). Degradation reduces forest cover despite their products being used by eight percent of Kenyans (Swallow & Meinzen-dick, 2008 & Lake Victoria South Catchment Area, 2012). Like many countries, Kenya is faced with inter-related constraints in terms of limited resources, food insecurity and competition for natural resources due to watershed degradation (Heiner, K., Shames, S. & Spiegel, 2016). It affects well-being of watersheds which provides goods and services to communities (Kieti et al., 2016). The country is experiencing faster depletion of natural resources than they are replenished for example around Lake Naivasha there is water scarcity due to water over use by horticulture and industries in the area (World Bank, 2016). Watershed degradation results in low productivity of watersheds due to human activities (Mainuri & Owino, 2016).

Farmers’ Attitude on Watershed Management Practices promoted in the Catchments
Farmers’ attitude plays a major role in uptake of watershed management practices and they may choose to take up the practices or not. Positive attitude contributes to high uptake of watershed management practices (Hosseini, Daryaei, & Rahnama, 2014). Farmers’ positive attitude in terms of water resource management and behavioral change contribute to enhanced responses on watershed conservation and enhance investment in the practices (Pino, Toma, Rizzo, Miglietta & Peluso, 2017). Their positive attitude, beliefs and readiness to change increases uptake of the practices (Wisdom & Chor (2013). Positive environmental attitude encourages farmers to take up watershed management practices as they anticipate positive change (Prokopy, Towery & Babin, 2013). The positive attitude towards land degradation, benefits of soil and water conservation practices and increased land productivity enhance uptake of the practices (Kipngenyo, 2007). Farmers with positive attitude towards alleviation of soil erosion on their farms take up soil and water conservation practices to reduce the erosion and improve productivity (Kerse, 2018). Further, attitude shapes the farmers’ opinion in terms of uptake of watershed management practices. Positive attitude is significant in uptake of practices and maintenance of degraded watersheds (Wolka & Negash, 2014). A study in Iran showed that farmers’ positive attitude on uptake of watershed practices and acceptance of soil erosion as a major constraint contributed greatly to uptake of the practices (Hosseini et al., 2014). Support from the Government and private organizations motivated development of a positive attitude among farmers to take up soil and water conservation practices leading to enhanced uptake of the practices (Zerssa, Bezabih & Dinkecha, 2017). High rate of uptake for soil and water conservation practices is enhanced by ease of use, low cost and their effectiveness among farmers with positive attitude (Junge, Deji, Abaidoo, Chikoye & Stahr, 2009). In addition, most farmers who take up soil and water conservation practices show interest in taking up the practices. Short term impact, positive attitude of the practices and benefits increase the rate of uptake of the practices among farmers (Mithun, 2013). They can take up many practices as long as benefits are higher than their cost of implementation (Kipngenyo, 2007).

II. IDENTIFY, RESEARCH AND COLLECT IDEA

Geographical Description of the Study Area
The survey was conducted in rivers Kibuon and Tende catchments which cover Kisii, Nyamira and Homa Bay Counties in South West Kenya. The area was purposively selected because of having implemented a project on watershed management. The study area receives rain twice in per year; Homa Bay County is located between LM1 to LM2 agro ecological zones and receives 450-1000 mm of rain per year. Kisii County lies between LH3 to LH4 agro ecological zones and receives rainfall range between 1500mm to 2000mm per year while Nyamira County is situated between LH4 to UM2; agro ecological zones and receives between 1500 mm to 2000mm of rain per year. The catchments run from Nyamira, Kisii Counties through Homa Bay County into Lake Victoria. Kibuon catchment was divided in 3 sub catchments; Kibuon (K1), Kabondo (K2) and Kasipul (K3) sub catchments while Tende catchment was divided in three sub catchments namely; Tende (T1), Isanta T2 and Mogusii (T3) sub catchments. Tende (T1) and Kibuon (K1) are situated in the upper part of the two catchments. Kibuon (K2) and Tende (T2) are found in middle catchments while Kibuon (K3) and Tende (T3) are situated in the lower parts of both catchments.

Research Design
The design was an ex post facto research design with cross sectional survey approach which combined qualitative and quantitative data collection methods. Ex post facto is a systematic empirical enquiry without alteration of independent variables since they had already taken place (Manjunath, 2014). Both primary and secondary data were utilized. Primary data was gathered from respondents and key informants using interview schedules and questionnaires respectively. Additional data was collected through observation. Reports, policy documents and books from Government institutions provided secondary data. The design was suitable because the farmers interviewed had equal opportunities to participate in the research since they implemented the project and conditions were not changed during the interview.

Population of the Study
The target population was 68 CBOs that participated in implementation of ILWMKTP project with a membership of 9,475 farmers in the project area (Ndeda, 2014). The accessible population was 370 members of 34 CBOs.
3.5. Sample Size and the Sampling Techniques

The research area was selected purposively because it implemented a project on watershed management. Proportionate multiple-stage cluster sampling method was used and the study area divided into subcatchments based on the area where the project was implemented and each subcatchment was represented by a number of CBO members. Through proportionate simple random sampling, 50 per cent of the CBOs were selected for the survey. Simple random sampling method was used to get respondents proportionately in every CBO. From 68 CBOs, 34 CBOs were systematically selected each member was selected through simple random sampling procedures. A sample size table by Krejcie and Morgan (1970) in a research paper by Hashim, (2010) recommends a sample size of 370 people from a population of 10,000 people. Nine staff who participated in implementation of the project were interviewed and 370 respondents who were distributed to each subcatchment proportionately were also interviewed.

Instrumentation

The study applied interview schedule and questionnaire to respondents and key informants respectively to gather data. A research tool was developed to examine respondents’ attitude on watershed management practices. This ensured that data collected met the objective of the study. The study also used observation to gather additional data. Data collected was generalized to a wider area although care and more research needed to be conducted since there are different factors which contribute to uptake of watershed management practices in different areas.

Data to be collected

Data was collected from respondents and key informants from both Kibuon and Tende catchments. The data gathered was on general characteristics of respondents and farmers’ attitude on watershed management practices promoted in the catchments.

Data Collection Procedures

Through Kisii University, a research permit was sought from National Commission of Science, Technology and Innovation (NACOSTI). Agriculture Department in the study area was informed and data was collected from respondents through face to face interview. The research utilized primary and secondary data which was collected from books, journals, reports, policy documents and research papers. Secondary data collected was complemented by data from face to face interview that was conducted in the subcatchments. Data from the farmers and extension staff was triangulated to inform conclusions that were drawn.

Data Analysis

Quantitative data was analyzed using statistical package for social sciences version 25 while qualitative data was dummy coded and analyzed using SPSS also. Descriptive statistics was used to determine frequencies, means and standard deviations among subcatchments in terms of watershed management practices. For inferential statistics, ANOVA was used to compare means in subcatchments on watershed management practices. Tukey post hoc determined significant differences on watershed management practices. The results were rated on a 5 point likert scale where 1 represented strongly disagree, 2 was disagree, 3 was neutral, 4 was agree and 5 represented strongly agree. Level of significance for inferential statistics was set at 0.05% (Table 3).

Table 1: A Summary of Data Analyses for the Hypothesis

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent variables</th>
<th>Dependent variable</th>
<th>Statistical method</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₀₁ There is no statistically significant difference in farmers’ attitude on watershed management practices promoted in the catchments.</td>
<td>-Attitude</td>
<td>-Terracing</td>
<td>ANOVA, Tukey post hoc test, frequencies, mean, standard deviations were used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Cover cropping</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Grass establishment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Agro forestry</td>
<td></td>
</tr>
</tbody>
</table>

III. RESULTS AND DISCUSSIONS

General Respondents’ Characteristics

Gender of the Respondents

The study interviewed 370 respondents who constituted by 63.2 percent men and 36.8 percent women. Most of the project implementers (234) out of 370 were men while 136 were women. Many women participated in biological and alternative economic enterprises that were not labour intensive to manage for example poultry production, goat rearing and fish farming in the catchments. Decisions on land use were made by men who also provided labour for tedious work in terms of terraces construction. Men were expected to motivate women positively towards watershed management practices and engage them in field activities through provision of labour. These findings agreed with a research report by Wagayehu and Lars (2015) in their study on adoption of soil and water conservation measures which established that although men were heads of households and responsible for decision making on farm activities, women provided primary labour. Increase in labour requirements in soil and water conservation activities is achieved through involvement of women in farm activities to control soil erosion by implementing decisions made by men (Tennyson, 2005). Promotion of gender participation by FAO in activities in watershed programmes and their direct involvement has been successful through provision of labour and skills in uptake of practices in watersheds thereby increasing uptake rate (Table 4).

Table 2: Gender of the Respondents

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Age of Respondents
Most of the respondents interviewed (74.3 percent) were above 40 years of age and majority were between 50-60 years old while 5.7 percent were below 40 years of age. The lowest percentage (1.4%) was represented by respondents who were below 30 yearsout of the total sample size (Table 5). Data analysis indicated that participation in watershed management technologies was influenced by age. Land was valued by older people compared to young people therefore they made the decision to participate in soil and water conservation activities to conserve the watersheds which improved soil fertility and translated in increased productivity. This is in line with findings by Bayard, Jolly and Shannon (2006) in their study on adoption and management of soil conservation practices in Haiti which indicated that age influenced participation in soil and water conservation whereby uptake increased with progression in age which was also reported by (Sheikh, Redzuan, Samah, & Ahmad, 2014) in their study on factors influencing farmers’ participation in water management.

Table 3: Age Ranges for Respondents

<table>
<thead>
<tr>
<th>Age ranges</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30 years</td>
<td>5</td>
<td>1.4</td>
</tr>
<tr>
<td>30-40 years</td>
<td>16</td>
<td>4.3</td>
</tr>
<tr>
<td>40-50 years</td>
<td>58</td>
<td>15.7</td>
</tr>
<tr>
<td>50-60 years</td>
<td>221</td>
<td>59.7</td>
</tr>
<tr>
<td>Above 60 years</td>
<td>70</td>
<td>18.9</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>100</td>
</tr>
</tbody>
</table>

Marital Status
Many farmers interviewed were married (99.5 percent). Married men had more labour for soil and water conservation practices implementation provided by wives and children compared to those who were not married. The project worked with men, women and youth who were either married or single (Table 6). Men made decisions on which soil and water conservation practices to be taken up on their farms while women and youth implemented decisions made by providing family labour. They participated in watershed management to restore productivity in maize, milk and forage for improved household income through enhanced watershed management. Similar observations were reported by Rehema (2014) in her study on factors influencing adoption of soil conservation measures in Tanzania which established that married women participated in soil conservation to increase family income although decisions on practices were made by men. German, Mansoor, Alemu, Getachew, Mazengia, and Stroud, (2006) confirmed in their study on participatory integrated watershed management that successful watershed management needed to address constraints affecting both women and youth in relation to decision made by men in the catchment for active participation by family members. There was need to consider female domains like reduced areas under agroforestry reflected in less wood fuel and how land use practices affected livelihoods of the people living in catchments.

Table 4: Marital Status

<table>
<thead>
<tr>
<th>Marital status</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Married</td>
<td>368</td>
<td>99.5</td>
</tr>
<tr>
<td>Not married</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>100</td>
</tr>
</tbody>
</table>

Farmer’s Level of Education
Majority of the respondents had primary level of education followed by secondary level while the least percentage (1.4 percent) of respondents attained tertiary level of education (Table 7). This implied that farmers were able to participate and implement soil conservation practices as long as they had basic education and were taken through the trainings which was similarly reported by Lesch and Wachenheim (2014) in their study on factors influencing conservation practice adoption in Agriculture which reported that education was inconsistent in participation of respondents in soil and water conservation practices. Uptake of watershed management technologies increases with proper trainings regardless of education level which does not agree with findings by Sheikh et al. (2014) in their study on factors influencing farmers’ participation in water management who found out that education influenced implementation of soil and water conservation technologies in the catchment.

Table 5: Farmers’ Level of Education

<table>
<thead>
<tr>
<th>Age ranges</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not gone to school</td>
<td>33</td>
<td>8.9</td>
</tr>
<tr>
<td>Primary level</td>
<td>193</td>
<td>52.2</td>
</tr>
<tr>
<td>Secondary level</td>
<td>130</td>
<td>35.1</td>
</tr>
<tr>
<td>Middle level college</td>
<td>9</td>
<td>2.4</td>
</tr>
<tr>
<td>Tertiary</td>
<td>5</td>
<td>1.4</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>100</td>
</tr>
</tbody>
</table>
Size of Family

There were varied family sizes whereby majority had more than 5 family members (70 percent), followed by 5 members (23.8 percent) and the rest had between 2-4 family members (Table 8). Many households provided labour needed for implementation of watershed management practices in the catchments which did not agree with a study by Tadesse and Belay (2004) on factors influencing adoption of soil conservation measures in Southern Ethiopia which established that family size affected participation in watershed management practices negatively. High number of households capitalized on short term benefits and would not consider participating in soil conservation whose benefits are long term. Similar findings were reported by Mutuyimana (2015) in her findings on effects of integrated soil and water management on livelihoods which reported family size being important for active participation by farmers in soil and water conservation.

Table 6: Family Size for Respondents

<table>
<thead>
<tr>
<th>Number of family members</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>.5</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>1.4</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>4.3</td>
</tr>
<tr>
<td>5</td>
<td>88</td>
<td>23.8</td>
</tr>
<tr>
<td>Above 5</td>
<td>259</td>
<td>70</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>100</td>
</tr>
</tbody>
</table>

Size of Land

Sizes of land ranged between ½ an acre to more than one acre. Half of the respondents (49.7 percent) owned more than one acre, thirty nine point nine percent (39.9 percent) owned one acre and 10.8 percent had less than one acre of land (Table 9). Most of the respondents who implemented Integrated Land and Watershed Management Project in Tende and Kibuon had more than 1 acre of land because some of the practices required more space for their construction while those with smaller pieces of land put one retention ditch on the upper part of their farms and invested in cover crops and agroforestry along the fence. These findings were also reported by Tadesse and Belay (2004) on factors influencing adoption of soil conservation measures in Southern Ethiopia who reported size of land being positive and significantly influenced uptake of soil conservation technologies. Smaller sizes of land restricted implementation of physical technologies which agreed with findings by Mutuyimana (2015) in effects of integrated soil and water management on livelihoods in Rwanda which established that size of land affected uptake of soil and water conservation technologies.

Table 7: Size of Land

<table>
<thead>
<tr>
<th>Acres</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>½ acre</td>
<td>10</td>
<td>2.7</td>
</tr>
<tr>
<td>¾ acre</td>
<td>30</td>
<td>8.1</td>
</tr>
<tr>
<td>1 acre</td>
<td>146</td>
<td>39.5</td>
</tr>
<tr>
<td>More than one acre</td>
<td>184</td>
<td>49.7</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>100</td>
</tr>
</tbody>
</table>

FARMERS’ ATTITUDE ON WATERSHED MANAGEMENT PRACTICES

Attitude towards watershed management practices was determined on a five point likert scale in which 1 represented strongly disagree, 2 was disagree, 3 was neutral, 4 was agree while 5 represented strongly agree. Data was subjected to ANOVA to compare means, descriptive statistics determined frequencies, means and standard deviations while Tukey post hoc was used to determine significant differences. Responses rated on a 5 point likert scale were analyzed, discussed and presented in a frequency, mean and standard deviations, ANOVA and Tukey post hoc tables.

Productivity is Reducing because of Soil Erosion

The following means and standard deviations were achieved; Kibuon K2 had a mean of 4.30 and standard deviation of 0.709, Kibuon K1 had a mean of 4.20 with a standard deviation of 1.082, Tende T1 had a mean of 4.01 with a standard deviation of .595, Mogusi T3 had a mean of 4.00 with a standard deviation of .795. This was followed by Kasipul K3 with a mean of 3.94 and standard deviation of .785. Sub catchment with the least mean was Isanta T2 with a mean of 3.83 and .601 standard deviation (Table 157).

Table 8: Means on Productivity Reducing because of Soil Erosion

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>4.20</td>
<td>1.082</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>4.30</td>
<td>.709</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.94</td>
<td>.785</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>4.01</td>
<td>.595</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.83</td>
<td>.601</td>
</tr>
<tr>
<td>Mogusi T3</td>
<td>39</td>
<td>4.00</td>
<td>.795</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>4.04</td>
<td>.703</td>
</tr>
</tbody>
</table>
ANOVA results showed that there were significant difference at \( F = 3.277, \ p = .007 \) on the level at which productivity was reducing due to soil erosion in different sub catchments. This indicated that sub catchments were significantly different which implied that attitude on soil erosion reducing productivity varied from one sub catchment to the other (Table 158). Multiple comparisons showed that Kibuon K2 and Isanta T2 had significant mean difference of .470 significant at .005 which indicated that scores on productivity reducing due to soil erosion varied in Kibuon K2 and Isanta T2.

<table>
<thead>
<tr>
<th>Variations</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>7.857</td>
<td>5</td>
<td>1.571</td>
<td>3.277</td>
<td>.007</td>
</tr>
<tr>
<td>Within Groups</td>
<td>174.535</td>
<td>364</td>
<td>.479</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>182.392</td>
<td>369</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Through Tukey post hoc, Isanta T2 was similar to Kasipul K3, Mogusii T3, Tende T1 and Kibuon K1 and significantly different from Kibuon K2. Many respondents in Kibuon K2 reported productivity reducing due to soil erosion followed by Kibuon K1, Tende T1, Mogusii T3, Kasipul K3 and Isanta T2. Kasipul K3, Mogusii T3, Tende T1 and Kibuon K1 were not significantly different from any sub catchment (Table 159).

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.83</td>
<td></td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.94</td>
<td>3.94</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>4.00</td>
<td>4.00</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>4.01</td>
<td></td>
</tr>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>4.20</td>
<td></td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>4.30</td>
<td></td>
</tr>
<tr>
<td>Significant</td>
<td>.174</td>
<td>.203</td>
<td></td>
</tr>
</tbody>
</table>

A high mean value (4.30) of respondents from Kibuon K2 reported productivity reducing because of soil erosion. Kibuon K1 followed closely with a mean difference of 3.20. Tende (mean - 4.01) was third followed by Mogusii T3 (mean- 4.00), Kasipul K3 (3.94) and lastly Isanta T2 (mean of 3.83). Most means were above 4.00 an indication that the respondents were aware that productivity was reducing due to soil erosion which was an indication of positive attitude towards watershed management practices promoted in the catchments. The positive attitude encouraged implementation of soil conservation practices improving on productivity. Analyzed data had an average mean running from 3.83 to 4.30 which indicated that many respondents had a positive attitude towards watershed management practices because of soil erosion which was confirmed by Worku and Tripathi (2015) in their research on watershed management in Highlands of Ethiopia which reported that land degradation, soil erosion and deforestation have contributed to reducing productivity and food shortage in Ethiopia. These findings were also reported by Abebe (2018) in his study on impact of soil and water conservation for improved agricultural production in Ethiopia who reported annual yield in Ethiopia was decreasing due to soil erosion and soil fertility due to absence of soil conservation practice.

Absence of Soil Conservation Practices on a Farm Contributes to Low Yields

Data gathered was subjected to the descriptive statistics and various means and standard deviations achieved; Kibuon K2 had a mean of 4.04 with a standard deviation of 1.060. Isanta T2 had a mean of 3.77 with a standard deviation of .520. Kasipul K3 had a mean of 3.75 with a standard deviation of .997. Mogusii T3 had a mean of 3.67 with a standard deviation of .662 and Tende T1 had a mean of 3.62 and standard deviation of .654. Kibuon K1 had a mean of 4.37 and a standard deviation of 1.060 (Table 160).

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.47</td>
<td>1.060</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>4.04</td>
<td>.731</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.75</td>
<td>.997</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.62</td>
<td>.654</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.77</td>
<td>.520</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.67</td>
<td>.662</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>3.74</td>
<td>.744</td>
</tr>
</tbody>
</table>

There were significant differences at \( F = 3.692, \ p = .003 \) through ANOVA on the levels at which absence of soil conservation technologies contributed to low yields in different sub catchments (Table 161). Multiple comparisons showed Kibuon K2 and Tende T1 had significant mean difference (mean difference .421, significant at .001) which implied that respondents in the two sub catchments scored differently on absence of conservation technologies contributing to low yields.

<table>
<thead>
<tr>
<th>Variations</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></td>
<td>5</td>
<td>1.571</td>
<td>3.277</td>
<td>.007</td>
</tr>
<tr>
<td>Within Groups</td>
<td>174.535</td>
<td>364</td>
<td>.479</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>182.392</td>
<td>369</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Homogenous sub sets displayed results in two columns. Kibuon K1 reported less on absence of soil conservation technologies contributing to low yields in comparison with Tende T1, Mogusii T3, Kasipul K3 and Isanta T2. It was significantly different from Kibuon K2 which reported more absence of soil conservation technologies contributing to reduced yields. Tende T1, Mogusii T3, Kasipul K3 and Isanta were not significantly different from any sub catchment (Table 162).

Table 13: Tukey Post Hoc Results on Absence of Soil Conservation Practices Contributing to Low Yields

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.47</td>
<td></td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.62</td>
<td>3.62</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.67</td>
<td>3.67</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.75</td>
<td>3.75</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.77</td>
<td>3.77</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td></td>
<td>4.04</td>
</tr>
<tr>
<td>Significant</td>
<td>.462</td>
<td></td>
<td>.114</td>
</tr>
</tbody>
</table>

Kibuon K2 was ranked first in responses on absence of soil conservation practices contributing to low yields. This showed that many respondents in the sub catchment knew that absence of soil conservation practices contributed to low yields. Isanta T2 was second in the ranking while Kibuon K1 had the least report which implied that a smaller number of respondents knew that absence of soil conservation practices on a farm contributed to low yields. Sub catchments had means ranging from 3.47 to 4.04 which showed that they agreed to the positive statement which was an indication of positive attitude which contributed to implementation of soil conservation practices improving yields. Those who did not implement them had low productivity confirmed by Worku and Tripathi (2015) in their report on watershed management in Highlands of Ethiopia who reported that fertile land for agricultural production was reducing in Ethiopia due to soil erosion following absence of soil conservation practices. This hampered the country from producing enough food for the increasing population which agreed with findings by Govers, Merckx, Wesemael, Van and Oost (2017) in their study on soil conservation in the 21st century who reported soil erosion contributing to imbalances in soil thereby outrstripping productivity resulting in decreased yields.

Generally Yields Correspond Positively to Soil Depth

Data collected was subjected to descriptive statistics and the following means and standard deviations were achieved: Kasipul K3 had the highest mean of 3.92 and a standard deviation of .744. Kibuon K2 had a mean of 3.89 and a standard deviation of .843, Kibuon K2 had a mean of 3.89 and a standard deviation of .843, Mogusii T3 had a mean of 3.72 with a standard deviation of 0.759. Isanta T2 had a mean of 3.55 and a standard deviation of 6.686, Tende T1 had a mean of 3.49 and standard deviation of .778 while Kibuon K1 had a mean of 3.20 and standard deviation of 1.082 (Table 163).

Table 14: Means on Yields Correspond Positively to Soil Depth

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.20</td>
<td>1.082</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>3.89</td>
<td>.843</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.92</td>
<td>.744</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.49</td>
<td>.778</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.55</td>
<td>.686</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.72</td>
<td>.759</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>3.65</td>
<td>.808</td>
</tr>
</tbody>
</table>

Further, ANOVA test results indicated that there were significant differences at F = 4.819, p = 0.000 on the level at which yields correspond positively to soil depth in different sub catchments (Table 164). Multiple comparison presented 4 pairs of sub catchments that were significantly different from each other; Kibuon K2 and Kibuon K1 had significant difference, 686 significant at 0.028, Kibuon K2 was different from Tende T1 with 0.392 mean difference significant at 0.009, Kasipul K3 and Kibuon K1 were significantly different with 0.722 mean difference and 0024 significance while Kasipul K3 was significantly different from Tende T1 with a mean difference of 0.428 mean difference significant at .011.

Table 15: ANOVA Results on Yields Correspond Positively to Soil Depth

<table>
<thead>
<tr>
<th>Variations</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean squares</th>
<th>F</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>14.939</td>
<td>5</td>
<td>2.989</td>
<td>4.819</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>225.680</td>
<td>364</td>
<td>.620</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>240.619</td>
<td>369</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Homogenous sub sets were in two columns. Kibuon K1 reported less on yields corresponding to soil depth compared to Tende T1, Isanta T2, Mogusii T3, Kibuon K2 and Kasipul K3. Tende T1 and Isanta T2 were not significantly different to any sub catchment (Table 165).

Table 16: Tukey Post Hoc Analysis Results on Yields Correspond Positively to Soil Depth

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.20</td>
<td></td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.49</td>
<td>3.49</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.55</td>
<td>3.55</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>51</td>
<td>3.72</td>
<td></td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>3.89</td>
<td></td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.92</td>
<td></td>
</tr>
<tr>
<td>Significant</td>
<td>.357</td>
<td>.159</td>
<td></td>
</tr>
</tbody>
</table>

Kasipul K3 had higher responses on yield corresponding positively to soil depth while Kibuon K2 was second. Kibuon K1 had the lowest responses on yields corresponding positively to soil depth. Low mean values for sub catchments indicated that some respondents did not know that yield generally corresponded positively to soil depth. There were high means ranging from 3.20 to 3.92 which indicated positive attitude by agreeing that yield corresponded positively to soil depth which agreed with a study by Hirzel and Matus (2013) in their study on effect of soil depth and increasing fertilization rate on yield and its components which reported that soil depth was found to affect crop yield, the height and number of tillers. Jabro, Stevens, Iversen and Evans (2010) in their study on tillage depth effects on soil physical properties reported that tillage depth loosened soil, increased water infiltration and fertilizer placement which contributed to higher yields than crops grown on shallow soils that reduce water infiltration.

Investing in Soil and Water Conservation on the Farm is Important

The following means and standard deviations were attained: Kibuon K2 had a mean of 3.97 and a standard deviation of .868. Kasipul K3 had a mean of 3.84 with a standard deviation of 0.903. Mogusii T3 had a mean of 3.72 and a standard deviation of 0.857. Tende T1 had a mean of 3.52 and a standard deviation of 0.884 which was followed by Isanta T2 with a mean of 3.51 and standard deviation of 0.718. Sub catchment with the least mean was Kibuon K1 with a mean of 3.47 and a standard deviation of 1.060. Many farmers in Kibuon K2 responded positively to investing in soil and water conservation on the farm being important compared to Isanta T2, Tende T1, Mogusii T3, Kasipul K3 and Kibuon K2.

Table 17: Means on Investing in Soil and Water Conservation is Important

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.47</td>
<td>1.060</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>3.97</td>
<td>.868</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.84</td>
<td>.903</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.52</td>
<td>.884</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.51</td>
<td>.718</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.72</td>
<td>.857</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>3.67</td>
<td>.884</td>
</tr>
</tbody>
</table>

ANOVA test results showed that there were significant differences at F= 3.470, p = 0.004 on the level at which investigating in soil and water conservation was important in different sub catchments (Table 167). Multiple comparisons showed Kibuon K2 and Tende T1 sub catchment were significantly different (.451 mean difference significant at 0.005).

Table 18: ANOVA Results on Investing in Soil and Water Conservation is Important

<table>
<thead>
<tr>
<th>Variations</th>
<th>Sum of squares</th>
<th>DF</th>
<th>Mean squares</th>
<th>F</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>13.108</td>
<td>5</td>
<td>2.622</td>
<td>3.470</td>
<td>.004</td>
</tr>
<tr>
<td>Within Groups</td>
<td>13.108</td>
<td>364</td>
<td>.756</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>288.111</td>
<td>369</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Homogenous sub sets were displayed in one column. Few respondents in Kibuon K1 were aware that investing in soil and water conservation on the farm was important compared to Isanta T2, Tende T1, Mogusii T3, Kasipul K3 and Kibuon K2. The sub catchments had more similarities on importance of investing in soil conservation on the farm which placed them in one column (Table 168).

Table 19: Tukey Post Hoc Results on Investing in Soil and Water Conservation being Important

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.47</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.51</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.52</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.72</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.84</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>3.97</td>
</tr>
<tr>
<td>Significant</td>
<td>.110</td>
<td></td>
</tr>
</tbody>
</table>
There were higher numbers of responses on investment in soil and water conservation being important from respondents in Kibuon K2 followed by respondents in Kasipul K3. Fewer respondents were from Kibuon K1 sub catchment. Means ranged between 3.47 and 3.97 which showed respondents’ positive attitude towards investing in soil and water conservation on the farm to be important. Those who had positive attitude invested in soil conservation technologies which controlled soil erosion and improved productivity. This was reported by (Dollinger, Dages, Bailly, Lagacherie and Voltz, 2015) on managing ditches for agro ecological engineering of landscape who reported that through food production agriculture was predisposing land to soil erosion, water pollution and biodiversity reduction which called for control of watershed degradation for continued agricultural production. This was supported by Mutuyimana (2015) in her study on no effects of integrated soil and water management on livelihoods in Rwanda who reported increase in agricultural productivity in Rwanda due to investment in soil conservation on farms.

Property Increase on the Farm through Soil and Water Conservation

Through descriptive statistics the following means and standard deviations were attained; Kasipul K3 sub catchment had the highest mean of 4.04 and a standard deviation of 0.916, Kibuon K2 sub catchment had a mean of 3.96 with a standard deviation of 0.873, Mogusii T3 had a mean of 3.64 and a standard deviation of 0.873, Tende T1 had 3.55 mean and a standard deviation of 0.868. Isanta T2 had a mean of 3.47 and a standard deviation of 0.873. Kibuon K1 had a mean of 3.13 with a standard deviation of 1.246 (Table 169).

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.13</td>
<td>1.246</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>3.96</td>
<td>0.875</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>4.04</td>
<td>0.916</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.55</td>
<td>0.868</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.47</td>
<td>0.873</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.64</td>
<td>0.873</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>3.68</td>
<td>0.918</td>
</tr>
</tbody>
</table>

ANOVA test results indicated that there were significant differences at \( F = 5.327, p = .000 \) on the level at which property increase on the farm through soil and water conservation in different sub catchments (Table 170). Multiple comparison showed that: Kibuon K2 and Kibuon K1 had .824 mean difference significant at .016, Kibuon K2 and Tende T1 had .410 mean difference significant at .021, Kibuon K2 and Isanta T1 had .410 mean difference significant at .045, Kasipul and Kibuon K1 had .906 mean difference significant at 0.008 and Kasipul K3 and Isanta T2 had 0.571 mean significant at 0.021. The findings showed that the sub catchments had some differences in their scores in relation to increase in property through investment in soil and water conservation.

<table>
<thead>
<tr>
<th>Variations</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>212.290</td>
<td>5</td>
<td>4.242</td>
<td>5.327</td>
<td>.000</td>
</tr>
<tr>
<td>Within Groups</td>
<td>289.872</td>
<td>364</td>
<td>.796</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>311.081</td>
<td>369</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Homogenous sub sets were displayed in two columns. Kibuon K1 reported less increase of property through soil and water conservation compared with Isanta T2, Tende T1, Mogusii T3, Kibuon K2 and Kasipul K3. Isanta T2, Tende T1 and Mogusii T3 were not significantly different from any sub catchment. Kasipul K3 reported high increase of property through soil and water conservation (Table 171).

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.13</td>
<td>3.47</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.37</td>
<td>3.55</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.55</td>
<td>3.55</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.64</td>
<td>3.64</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>3.96</td>
<td>3.96</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>4.04</td>
<td>4.04</td>
</tr>
<tr>
<td>Significant</td>
<td>0.124</td>
<td>0.056</td>
<td></td>
</tr>
</tbody>
</table>

Kasu K3 had a high number of respondents who reported property increase on the farm through soil and water conservation by improving soil fertility to enhance productivity. Improved productivity would be reflected in high income that could be used to buy assets on the farm. Kibuon K2 was second in reporting on the same variable followed by Mogusii T3 and the last sub catchment was Kibuon K1. The results indicated that some respondents in Kibuon K1 were not aware that investment in soil and water conservation could lead to acquisition of more property on the farm. The mean ranged from 3.13 to 4.04 which showed that many respondents agreed that investment in soil and water conservation led to increased property on the farm which was an indication of positive attitude. The positive attitude encouraged investing in soil conservation practices and improved agricultural productivity. Wolancho (2015) in his study on evaluating watershed management activities in Ethiopia reported that watershed management technologies enhanced ecological and environmental conditions of watersheds. It improved income of the community members who were able to use their income to increase their property on the farm. This was in agreement with...
findings by Tugizimana (2015) in his study on effects of soil and water conservation techniques which reported that soil conservation practices reduced soil erosion, increased soil fertility and improved crop yields which resulted in high maize yields in Ghana that was reflected in improved income which was used to buy and improve on farm implements.

Replacement of Eucalyptus Trees with Agroforestry Trees in the Riparian Areas Contributed to an Increase in Water Levels in Kibuon and Tende Rivers

Through descriptive statistics, different means and standard deviations for the sub catchments were attained. Kibuon K2 had a mean of 3.91 with a standard deviation of 0.794. Kasipul K3 had a mean of 3.84 with a standard deviation of 0.880, Isanta T2 had a mean of 3.79 and a standard deviation 0.657, Tende T1 had a mean of 3.68 with a standard deviation of 0.835, Mogusii T3 had a mean of 3.64 with a standard deviation of 0.843. Kibuon K1 had the lowest mean of 3.60 and a standard deviation of 0.910 (Table 172).

Table 23: Means on Replacement of Eucalyptus with Agroforestry trees in Riparian Areas

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.60</td>
<td>.910</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>3.91</td>
<td>.794</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.84</td>
<td>.880</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.68</td>
<td>.835</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.79</td>
<td>.657</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.64</td>
<td>.843</td>
</tr>
<tr>
<td>Total</td>
<td>370</td>
<td>3.75</td>
<td>.818</td>
</tr>
</tbody>
</table>

The ANOVA test result did no show significant difference at F= 1.202, p = .308 on the level at which replacement of eucalyptus trees were replaced by agroforestry trees in riparian area in different sub catchments (Table 173). Multiple comparisons failed to show sub catchments that were significantly different which implied similarities among sub catchments.

Table 24: ANOVA Results on Replacement of Eucalyptus with Agroforestry Trees in Riparian areas

<table>
<thead>
<tr>
<th>Variations</th>
<th>Sum of squares</th>
<th>Df</th>
<th>Mean square</th>
<th>F</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>4,014</td>
<td>5</td>
<td>.803</td>
<td>1.202</td>
<td>.308</td>
</tr>
<tr>
<td>Within Groups</td>
<td>243.110</td>
<td>364</td>
<td>.668</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>247.124</td>
<td>369</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Homogenous sub sets displayed one level that Kibuon K1 had the lowest report on replacement of eucalyptus trees with agroforestry in riparian areas contributed to increased water levels in Kibuon and Tende rivers while Kibuon K2 had the highest report on replacement of eucalyptus with agroforestry increased water in Kibuon and Tende rivers. Kibuon K1 reported less compared to Mogusii T3, Tende T1, Isanta T2, Kasipul K3 and Kibuon K2 (Table 174).

Table 25: Tukey Post Hoc Results on Replacement of Eucalyptus with Agroforestry Trees in Riparian Areas

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>N</th>
<th>Mean</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>15</td>
<td>3.60</td>
<td>.535</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>39</td>
<td>3.64</td>
<td>.535</td>
</tr>
<tr>
<td>Tende T1</td>
<td>148</td>
<td>3.68</td>
<td>.535</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>47</td>
<td>3.79</td>
<td>.535</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>51</td>
<td>3.84</td>
<td>.535</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>70</td>
<td>3.91</td>
<td>.535</td>
</tr>
</tbody>
</table>

Kibuon K2 sub catchment had high number of respondents who agreed that replacement of eucalyptus trees with agroforestry trees in riparian areas would contribute to water levels in Kibuon and Tende rivers. They knew that agroforestry trees do not have high water abstraction like eucalyptus which was planted near rivers and in swamps in the catchments. Kasipul K3 also had a fair level of knowledge on replacement of eucalyptus trees with agroforestry trees in riparian areas would increase water levels in rivers Kibuon and Tende. Kibuon K1 had the least number of responses although the differences were not significant. Most of the respondents interviewed agreed (mean of above 3) that eucalyptus trees should be replaced with agroforestry trees which agreed with (Kenya Forest Service, 2009) in their Guide to on-Farm Eucalyptus Growing in Kenya which indicated that they should not be planted in riparian areas, along rivers within less than 30 metres, on irrigated farms and areas that receive less than 400 mm of rainfall. This was confirmed by Khonkaen (2011) in his study on use of check dams in Watershed Management in which they determined that when eucalyptus trees were cut down from riparian areas water flow in rivers increased.

A Summary of Sub Catchment Ranks on Farmers’ Attitude on Watershed Management Practices

Using Tukey post hoc means, Kibuon K2 was ranked first in column 1 in three practices. The sub catchment had more responses on respondents’ attitude on watershed management practices promoted in the catchments. This showed that many respondents in Kibuon K2 sub catchment had positive attitude towards watershed management practices. In column 2 Kibuon K2 was ranked first in two practices. In column 3 Mogusii T3 was ranked first in three practices while in column 4 Mogusii T3 and Tende T1 were both ranked first in two different practices. In column 5 Tende T1 and Isanta T2 were ranked first each in two different practices. In column 6 Kibuon K1 was ranked first in 4 practices. Kibuon K1 had the least responses on respondents’ attitude on
watershed management practices promoted in the catchments because it was ranked last (6th) in four practices. This implied that fewer respondents had positive attitude towards watershed management practices in Kibuon K1 (Table 175).

Table 26: Ranked Levels of Farmers’ Attitude on Watershed Management Practices

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity is reducing because of soil erosion</td>
<td>Kibuon K2</td>
<td>Kibuon K1</td>
<td>Tende T1</td>
<td>Mogusii T3</td>
<td>Kasipul K3</td>
<td>Isanta T2</td>
</tr>
<tr>
<td>Absence of soil conservation technologies on the farm contributes to low yields</td>
<td>Kibuon K2</td>
<td>Isanta T2</td>
<td>Kasipul K3</td>
<td>Mogusii T3</td>
<td>Tende T1</td>
<td>Kibuon K1</td>
</tr>
<tr>
<td>Generally yields correspond positively to soil depth</td>
<td>Kasipul K3</td>
<td>Kibuon K2</td>
<td>Mogusii T3</td>
<td>Isanta T2</td>
<td>Tende T1</td>
<td>Kibuon K1</td>
</tr>
<tr>
<td>Investing in soil and water conservation on your farm is important</td>
<td>Kibuon K2</td>
<td>Kasipul K3</td>
<td>Mogusii T3</td>
<td>Tende T1</td>
<td>Isanta T2</td>
<td>Kibuon K1</td>
</tr>
<tr>
<td>Property increase on the farm through soil and water conservation</td>
<td>Kasipul K3</td>
<td>Kibuon K2</td>
<td>Mogusii T3</td>
<td>Tende T1</td>
<td>Isanta T2</td>
<td>Kibuon K1</td>
</tr>
</tbody>
</table>

Summary for Sub Catchments on farmers’ Attitude on Watershed Management Practices

Data on farmers’ attitude on watershed management practices was analyzed and sub catchments attained different positions. Kasipul got position 1 because it appeared in 4 columns. Position 2 was taken by Kibuon K2 which appeared in three columns and Isanta was third by appearing in 3 columns. Tende T1 was 4 because it was ranked in 3 columns. Mogusii T3 was 5 due to appearing in 2 columns while Kibuon K1 was in position 6 for appearing in 2 columns. The positions were assigned to sub catchments based ranks attained in practices tested on. The ranks ran from 1 (highest) to 6 (the lowest) and were based on means in Tukey post hoc tables. The means indicated differences in the level of attitude on different watershed management practices promoted in the catchments (Table 176). The higher the means the more positive attitude respondents had towards watershed management practices.

Table 27: Summaries for Ranks on Attitude on Watershed Management Practices

<table>
<thead>
<tr>
<th>Sub catchment</th>
<th>Ranks attained</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kibuon K1</td>
<td>2 and 6</td>
<td>6</td>
</tr>
<tr>
<td>Kibuon K2</td>
<td>1, 2 and 6</td>
<td>2</td>
</tr>
<tr>
<td>Kasipul K3</td>
<td>1, 2, 3 and 5</td>
<td>1</td>
</tr>
<tr>
<td>Mogusii T3</td>
<td>3 and 4</td>
<td>5</td>
</tr>
<tr>
<td>Isanta T2</td>
<td>2, 4 and 6</td>
<td>3</td>
</tr>
<tr>
<td>Tende T1</td>
<td>3, 4 and 5</td>
<td>4</td>
</tr>
</tbody>
</table>

Respondents who Agreed to the Positive Statements on Soil Conservation practices

A frequency table was run on respondents who agreed to the positive statements on soil conservation practices. About 39 percent of the respondents agreed that cover cropping contributed to watershed management. More than half (59.4 percent) of the respondents agreed that terracing controlled runoff speed while 51 percent reported that contour ploughing controlled watershed degradation. Majority of the respondents (70 percent) agreed that check dams controlled soil erosion. Grass strips reduced runoff flow was reported by 52.4 percent. About 71 percent agreed that retention ditches increased infiltration thereby reducing soil erosion. The findings showed that more than half of the respondents agreed that soil conservation practices contributed to watershed management which was an indication of positive attitude (Table 177).

Table 28: Frequency of Respondents who Agreed to the Positive Statements on Soil Conservation Practices

<table>
<thead>
<tr>
<th>Practices</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
<th>Total (Agreed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover cropping contributed to watershed management</td>
<td>1.6</td>
<td>8.9</td>
<td>50.3</td>
<td>27.8</td>
<td>11.4</td>
<td>39.2</td>
</tr>
<tr>
<td>Terracing controlled runoff speed</td>
<td>1.4</td>
<td>7.8</td>
<td>31.4</td>
<td>43.2</td>
<td>16.2</td>
<td>59.4</td>
</tr>
<tr>
<td>Contour ploughing controlled watershed degradation</td>
<td>3.8</td>
<td>11.1</td>
<td>33.8</td>
<td>38.4</td>
<td>13</td>
<td>51.4</td>
</tr>
<tr>
<td>Check dams controlled soil erosion</td>
<td>3.2</td>
<td>6.2</td>
<td>21.1</td>
<td>54.6</td>
<td>14.9</td>
<td>69.5</td>
</tr>
<tr>
<td>Grass strips reduced runoff speed</td>
<td>3.8</td>
<td>10.8</td>
<td>33</td>
<td>37</td>
<td>15.4</td>
<td>52.4</td>
</tr>
<tr>
<td>Retention ditches increased infiltration</td>
<td>2.7</td>
<td>8.6</td>
<td>17.3</td>
<td>57</td>
<td>14.3</td>
<td>71.3</td>
</tr>
</tbody>
</table>

IV. GET PEER REVIEWED

1. Conclusions should be derived from the findings. They should have supportive information emanating from the findings before they are stated.
2. All tables in the research paper should be formatted using guidelines provided by APA manual.

V. IMPROVEMENTS AS PER PEER REVIEW COMMENTS
The information provided by the peer helped in deriving conclusions by describing how the conclusion was drawn as opposed to stating the conclusion without explaining how it came about. Formatting of all tables was done according to APA manual

VI. CONCLUSION

Data analysis indicated different levels based on means in the sub catchments. Responses to test farmers’ attitude towards watershed management practices were analyzed and results indicated different levels (1-6 ranks). A frequency table for those who agreed to positive statements on watershed management practices ranged from 39.2 to 71.3 percent. The findings on farmers’ attitude towards different watershed management practices and frequency on those who agreed to positive statements on the practices showed different levels with an average mean of 3.00 which indicated positive attitude towards watershed management technologies. It was therefore concluded that respondents in the sub catchments had different levels of positive attitude towards watershed management practices.

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IT Projects in Top 3 Smart Cities in India: Existing Solutions, Challenges and Discussions for Future Scope

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Abstract. One of the essential pillars of developing a smart city, is the presence of efficient technology-based smart solutions. This paper aims to explore the existing smart solutions (proposed as well as implemented) in Indian smart cities by conducting a case study on the smart solutions present in Top Three smart cities in India. We discuss challenges hindering development of smart cities in India, in the context of technological advancement. We study existing solutions in smart cities worldwide which may be incorporated in Indian cities. We initiate discussions regarding the development and implementation of solutions in smart cities.

This is done with the help of information provided through reports by concerned government departments and by analyzing existing scientific and economic literature.

Keywords: Smart Cities, Pune, Jaipur, Bhubaneswar

1. Introduction

The concept of Smart Cities gained traction with the Smarter Planet Initiative of IBM in 2008, later giving rise to Smarter Cities initiative by IBM in 2009 [1]. In the year 2015, the Government of India rolled out the ‘Smart Cities Mission’ with an aim to drive economic growth and improve the quality of life for people in 100 selected cities (S. Praharaj et al. [2]).

Despite the lack of a formal definition for the term ‘Smart City’, a Smart City embeds ICT solutions at different levels: from infrastructural (by use of sensors and ICT) to governance level by using ICT to realize e-governance (E. Bigne et al. [3]).

Of all the desirable features listed by Ministry of Urban Development (MoUD) of India which are essential to a smart city, technology will play a vital role in aiding following crucial features [4]:

- Creating walkable localities.
- Promoting a variety of transport options.
- Making governance citizen friendly and cost effective.
- Applying Smart Solutions to infrastructure and services in area-based development in order to make them better.

In an unprecedented move, MoUD declared a ‘City Challenge’ to rank cities based on their performance. This was done in two stages: in the first stage, 100 smart cities were shortlisted. In stage two, the shortlisted cities submit an SCP i.e. Smart City Proposal, for their planning and development vision. Thereafter, the winning cities will be ranked by various committees and boards and be expected to implement their SCPs [4].

These rankings are based on three parameters of scoring, and the parameter which interests us, in the scope of this paper is the second parameter i.e. use of ICT in resulting in change of Administrative Efficiency [4]. The top three smart cities in India are Bhubaneswar, Pune and Jaipur respectively [4].

1.1. Case Study: Overview

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While there exist unique solutions across all smart cities in India implemented with the aid of IT, for the scope of our paper, we review technological solutions in top 3 smart cities in India. There also exist IT solutions available across India in every place, but these constitute a part of the Digital India Initiative - even if these solutions assist in providing IT support to citizens, these fall outside the scope of our paper. Digi Locker app, Aarogya Setu app and other such apps are few examples of such apps.

It is prudent for the reader to note that there might be an overlap in solutions across cities. An instance of this is the ‘e-challan system’, which is implemented in both: Bhubaneswar and Pune. However. We only describe the implementation of the same in the city of Bhubaneswar in brief. The intention behind this decision is to expand the list of unique projects covered in this paper to give the reader a more comprehensive idea of existing IT solutions. This does not, however, imply that the projects listed under each Smart City are unique to that city alone.

There are two components to Smart City Mission (SCM) in India: Pan-city component and Area Based Development (ABD) component (D. Prasad et al [5]). ABD focuses on utilizing new technologies such as smart street lights, smart meters etc while pan-city development focuses on using Command and Control Centres for unifying heterogeneous datasets. No distinction is made between the two components in the case study for ease of understanding, since we evaluate the smart city as a cohesive whole unit.

2. Case Study: (city-wise)

This case study aims to shed some light on the top performing smart cities of India and top performing projects under them.

2.1. Bhubaneshwar

Bhubaneshwar is a city with a population of 8.38 lakh residents according to the latest census [6]. The MoUD published a document containing smart solutions which have been proposed in all the smart cities across India. According to this document, the city of Bhubaneshwar implements the following projects:

1. Transit operations system (maintenance and tracking) [7]

BRTS (Bus Rapid Transit System) in Bhubaneshwar has intelligent features approved by CRUT (Capital Region Urban Transport) which lead to smooth operation of city bus systems. The Intelligent Transport Systems are achieved through the following key components:

- **Automatic Vehicle Location System (AVLS)**
  
  Essentially consists of a Global Positioning System (GPS) unit which is connected to a control centre to relay real-time location of the bus. This can be used for a variety of applications such as passenger tracking, monitoring vehicular speeds, estimating stop durations, traffic hold-ups and so on. AVLS can also be used for on-board passenger information systems which provide information about stops en route as well as route details.

  Currently, the AVLS captures GPS data at the rate of once every 10 seconds. However, if we wish to implement the driver behaviour prediction feature, data must be captured every 1 second.

- **Automatic Fare Collection System**
  
  Refers to cashless, electronic collection of bus fare using smart cards, QR codes, mobile ticketing, etc. Hand-held Electronic Ticket Vending Machines (ETVMs) can also be used for on-board ticketing.

2. Common card (payment and operations) [8]

Also known as CPCS, this is a proposed smart solution costing 19.19 crore rupees, and spanning over 6 to 8 months for implementation. It focuses on facilitating payment transactions for citizen services across the city. It has been proposed to be implemented through an open-loop smart card and mobile application-based payment system.

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These services primarily include:

- Payments related to buses & other transit modes
- Parking
- Municipal services (such as property tax and other charges)
- Utilities (such as electricity and water)
- Recreational & retail payments.

To achieve this, at least 325 machines will be installed across the city to facilitate payment services for citizens at accessible distances. The cards under this system will also be acceptable at euro, master, visa and rupay specification terminals. The broader objective is to enable citizens in accessing a unified system for all government and non-government services.

3. Area based traffic control i.e. Intelligent Traffic Control System [9]

A project costing 14.69 crores and spanning across 15 months for its implementation, the technology used for implementation is named as CoSiCoSt (Composite Signal Control Strategy) which has been developed by C-DAC (Centre for Development of Advanced Computing). Traffic Intersections in the city utilize Adaptive Traffic Signal Control System as well as pelican blinkers (safe, two-stage crossing for pedestrians using manual buttons).

This project benefits citizens by improving travel time reliability, reduces congestion, responds faster to traffic conditions and predicts traffic volumes to adjust signal timings. These signals have been installed at 43 intersections in the Bhubaneswar Smart City.

4. E-challans for traffic violations [10]

E-challan system is used to collect fines and taxes from citizens who commit vehicular offenses in Bhubaneswar. This achieves the dual-purpose of keeping a digital record of the offenders as well as maintaining transparency in the process of collecting fines. Mobile e-challan devices generate a vehicle check report (VCR) on the spot, thus alleviating the need for a manually generated VCR.

E-challan reports are generated with SARATHI and VAHAN databases. A total of 195 e-challan devices are to be provided to officers responsible for vehicular law enforcement.


The Centralized Command and Control Centre in Bhubaneswar is the largest such centre in India. The command centre is a multi-purpose project. Its functions include tasks like:

Traffic management, incident management, city surveillance, handling emergency services, disaster management and much more. Various external modules have been integrated into the control centre’s system to provide real-time decision support. Along with an adaptive traffic signal system, the Centralised Command and Control Centre will play a crucial role in tracking buses and municipal vehicles from a single place. It also incorporates a grievance redressal system.

Apart from these, other notable projects of interest to mention are: Smart Parking System, Emergency Response, Smart City Buses, Digital Kiosk.

2.2. Pune

Pune is a city with a population of 31.2 lakhs residents according to the latest census [6].

The MoUD published a document containing smart solutions which have been proposed in all the smart cities across India. According to this document, the city of Pune implements the following projects:
1. Traffic Mobile App [12]

This mobile application is launched under the name ‘Pune Traffic App’ by Pune Police in association with HardCastle GIS and Turnhere Designs, occupying around 9MB of memory space. Within its relatively compact size, it offers a host of features in English as well as the vernacular language Marathi, majority of which are as listed below:

- Exhaustive list of police stations in the city as well as a GPS feature to locate the police station in the city closest to the app user’s current location.
- Details of police personnel and their numbers; one-tap calling feature.
- Detailed list of traffic violations and fines associated with them.
- RTO approved Day and Night fare charts for Auto Rickshaws; also provides information regarding prepaid auto fares from bus station and railway station.
- Detailed list of emergency contact numbers such as hospitals, ambulance services, blood bank, fire brigades, crane services.
- Push notifications for updates on traffic rules and safety tips; live traffic details available on real-time basis.

2. Smart Metering for Water [13]

One of the most widely successful smart projects which has been successfully implemented in Pune Smart City, it is an innovative project for 24x7 water distribution. Smart Water Meters have been installed in households in various localities across the city. Upto 40-45% of water is lost before it reaches the end-customer in India. A company which specializes in providing smart solutions for water conservation -- Sensus iPerl -- is the start-up to which this ambitious initiative has been outsourced, claims that it will reduce this statistic to 15-20% loss of water supply.

325,000 smart water meters are to be deployed in the city over the course of next three years. These deal with two major segments: residential segment and commercial and industrial segment. These are monitored tailored to their respective behaviour sets. The smart water meter consists of three major parts:

- The meter i.e. the hardware itself
- Communication i.e. method of data transmission for the meter
- Data Analysis of communicated observations

This AI and IoT based technology can help detect customer-side leakage and pinpoint the exact location of the leak as it occurs.

3. CCTV Surveillance [14]

Pune city surveillance, referred to as PCS, is a holistic and integrated video surveillance system. It is beneficial in attaining the following four objectives:

- Support Pune police to Maintain law & order - Consists of a 24x7 live video feed, accompanied by a variety of automatic alerts.
- Act as an aid to investigation
- Improve traffic Management - in-built video analytics are leveraged to generate automatic alerts for traffic violation.
- Help in deterring and detecting criminal activities - Automatic alerts for crowd gathering, suspicious objects, suspicious loitering, automatic number plate recognition, aid the police to detect and deal with criminal activities efficiently.

The PCS system consists of a total of 1363 surveillance cameras, 78 of which are ANPR (Automatic Number Plate Recognition) cameras. They are spread across 412 locations throughout the city, along with 22 locations for the ANPR cameras. Live feed from 150 cameras at a time can be viewed at the Command and Control Centre in Pune.

4. Mobile app based SWM and cleanliness monitoring

SWM is an abbreviation for Solid Waste Management. Multiple applications exist to achieve the unified purpose of cleanliness monitoring and solid waste management in the city. At the forefront of this are two organizations: SWaCH (Solid Waste Collection and Handling services) and APCC (Adar Poonawalla Clean City) [15].

SWaCH has a website where interested citizens can contact them to join their movement, organize drives or browse information regarding initiatives by them [16]. It has partnered with Pune Municipal Corporation (PMC). It saves PMC around Rs. 15 Crore annually.

APCC App is the first of its kind movement started in Pune, with the APCC movement being a 100-crore initiative. It has around 2000 trucks and employs 400 employees. State-of-the-art machines are used to work towards these goals, in tandem with an app. The app is designed with the following features:

- Tracking location of smart garbage picking machines and bins.
- Upload an image of garbage along with details on the app; these are later processed by the server before being redirected to the nearest vehicle for clearing. On clearance, the user receives a message.
- View details of garbage details by other users as well as self-reports.

5. Intelligent road asset management [17]

The Pune Smart City Development Corporation Limited (PSCDCL) introduced a Road Asset Management System (RAMS) for better development of city roads by preparing a database of past three years. The project will require one year for data collection and succeeding three years for implementation, further data collection and data updation, and the initial target road length to be covered is around 2000 kilometres.

The operationality of the project is as follows:

- Collection of road assets and infrastructural data to assist in decision-making process, priority allocation to road servicing as well as providing data inputs so that the Municipal Corporation makes better budgeting policies.
- Launching a web-based tool for use by road engineers so as to centralize the process of road asset management.
- To provide accurate data analysis as judicious allocation of maintenance funds is dependent on this analysis.
- Determine the cost associated with providing various levels of serviceability for any given road section.

Apart from these, other notable projects of interest to mention are: ICT enabled billing and recovery department, grievance redressal through web, app and phone, smart bus stops, public Information system, WIFI- IT connectivity, Area based traffic control.
2.3. Jaipur

Jaipur is a city with a population of 3.0.7 lakhs residents according to the latest census [6].

The MoUD published a document containing smart solutions which have been implemented in all the smart cities across India. According to this document, the city of Jaipur implements the following projects:

1. Transit Operations system (maintenance and tracking) [18]

JSML is going to introduce a Passenger Information System in the public transport of Jaipur. With the introduction of the Passenger Information System, the commuters would be able to know the exact schedule and location of public transport in Jaipur as well as about the seat availability in JCTSL buses and Jaipur metro. Once this system is in place the main features would include:

- Schedule of JCTSL buses and Jaipur metro
- Location of buses and metro
- Seat availability
- Details for cabs

2. Common Card (payment and operations) [19]

The project aims to provide a common platform for the following services:

- Metro
- Cab
- Buses
- Parking
- ATM
- Retail outlets
- Restaurants

Some advantages are:

1) Increased Accountability

   (b) Reduces Fraud as it introduces a common platform which can be easily monitored.

   (b) Promotes Cashless Transactions and provides a platform with history and incentives.

   (b) Provides a platform for feedback and bags on the room for improvement.

2) Improved Efficiency

   (a) Handles complex tariff structures as it is electronically computed.

   (b) Automates collection of daily fares, improving efficiency and eliminating middle men.

3) Improved Convenience

   (b) Single card is introduced, connecting to all the services.

   (b) No Queues for tickets which saves time and aims for a seamless operation.

   (b) NFC enabled
3. Public transit and traffic operations management centre [18]

Under this project to make Jaipur's Public Transport Smarter, a control room would also be established in the city. From this control room, the movement of each and every city bus would be tracked through the Vehicle Tracking System (VTS) in each vehicle and also the GPRS enabling. The people at the control room would also be able to see who boards the bus at designated stops through CCTV.

4. GPS tracking and optimisation of routes of garbage trucks: [20]

A Vehicle tracking system was proposed to track garbage trucks, which would help in optimizing tracks and fleet for the same.

The proposal included:
- Vehicle tracking system (VTS)
- Fleet management
- People management / attendance monitoring
- Route optimization / Service scheduling
- Monitoring of Door to Door collection
- Integration of weather data
- Vehicle maintenance module
- Bin monitoring
- Multiple touch points for complaints registration & redressal

5. Journey Planner [18]

The App is proposed to streamline Jaipur’s public transport sector. It is proposed to have:
- the possible routes available to make the trip
- the frequency and timing of JCTSL buses along with fare information
- the latest metro routes including information about the route, frequency and fare

<table>
<thead>
<tr>
<th>Sr No</th>
<th>City</th>
<th>App Project Name</th>
<th>Brief Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Bhubaneswar</td>
<td>Integration of public and privately owned (publicly accessible) parking availability data on to common platforms and parking mobile apps.</td>
<td>Parking availability data on to common platform and parking mobile app</td>
</tr>
<tr>
<td>2</td>
<td>Bhubaneswar</td>
<td>Emergency response intake through call, app or panic-button, CAD; First Responder Coordination</td>
<td>Emergency Response and City Incident Management through app</td>
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<td>3</td>
<td>Bhubaneswar</td>
<td>Bus Services Operations</td>
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<td>4</td>
<td>Pune</td>
<td>Bus System Intelligent Traffic Management System (ITMS)</td>
<td>Smart Public Transport for Pune - Real - time tracking of buses using GPS - Maintenance using vehicle health monitoring system - Passenger information system (PIS) with</td>
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<td>No.</td>
<td>City</td>
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<td>5</td>
<td>Pune</td>
<td>e-Challan</td>
<td>e-challan systems with smart challan payments. Cops to be equipped with android based e-challan tablets.</td>
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<tr>
<td>6</td>
<td>Pune</td>
<td>Mobile App and Website for Pan City Water</td>
<td>Grievance redressal and bill payment through website and mobile app.</td>
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<tr>
<td>7</td>
<td>Jaipur</td>
<td>Air Quality Monitoring with App</td>
<td>Air Quality Monitoring Application to be developed to create mega data and to be accessible by citizens.</td>
</tr>
<tr>
<td>8</td>
<td>Jaipur</td>
<td>Mobile application enabling citizens to report street problems connecting to e-government portal</td>
<td>Development of 'In My Street App enabling citizens to report street problems.</td>
</tr>
<tr>
<td>9</td>
<td>Jaipur</td>
<td>Incident alerts app, Helpline and SOS Mobile number and Panic Buttons</td>
<td>Development of app for Safety of citizens especially children, woman and elderly.</td>
</tr>
<tr>
<td>10</td>
<td>Jaipur</td>
<td>Journey Planner App</td>
<td>Development of app for streamlining Jaipur's Public Transport sector. This app would integrate all means of the city's public transport sector which includes JCTSL buses, Jaipur metro and cab services.</td>
</tr>
</tbody>
</table>

Table (1): App-Based Solutions in Smart Cities

5. Challenges

A plethora of challenges are experienced in the Smart City Mission, and existing literature points towards a variety of factors related to governance, infrastructure, economic policies and environmental policies. A few challenges in relation to the technological context are elucidated below.

According to technological barriers to development of smart cities in the Indian context (N.P Rana, et al [21]), the following points have been brought to attention:

1. Lack of technological knowledge among the planners.
2. Lack of access to technology.
3. Privacy and security issues.
4. System failure issues due to vulnerability to cyber-attacks and other incidents such as industrial espionage, terrorism, equipment failure.
5. Integration and convergence issues across IT networks.
6. Poor data availability and scalability.

Lack of timely updates on government portals and websites makes it difficult for citizens to ascertain how far along the project is in its implementational journey - this can only be remedied by responsible governance which is intent on providing transparent and updated information for further scrutiny.

Previous policy failure in India brought about a shift in its urban policies from being infrastructure-centric to market-centric. Considering this shift in the national urban policies, it is argued that smartness in India is a vague concept. It was simplified as either the use of technology in governance and planning or as greenfield construction of urban hubs to draw international investors (D. Prasad et al [5]) which leads to underwhelming focus on other aspects of smart cities.

Focus on economic growth in smart cities in India often comes with an increase in urban inequality. (D. Prasad, et al [5]). This goes against the principle that technology in smart cities should alleviate rather than assists in maintenance of status quo in smart cities.

The smart cities mission guideline published by the Government of India does not have a clear framework or outline regarding
how different initiatives will be coordinated for the common good of the city (S. Praharaj, et al [2]), which will act as a hindrance in IT integration, where well-defined architecture and planned conglomeration is key.

5. Discussions

Before beginning the discussions surrounding smart cities in India, it would do well to recollect that the Indian Smart Cities Mission is a city-driven exercise, managed by MoUD. There is a vast service delivery infrastructure gap that India needs to cover compared to countries with successful implementation of Smart Cities.

That being said, we observe a lack of artificial intelligence-based solutions in smart cities in India, despite the vast potential of the field. The successful application of AI requires a good understanding of the relationships between AI and data as well as transportation system characteristics and variables (Nikitas, et al [22]). The range of AI-based technologies which can be exploited to make a smart city technological sound in a study (Nikitas, et al [22]) is versatile and varied. Indian Smart Cities fall remarkably short of successfully implementing these.

Smart City Hackathons are conducted across major smart cities in India where youth present innovative ideas and are provided incubation for implementation of their solutions; a majority of these ideas are in the fields of IoT using drones for surveillance or using AI for computer vision or decision-making and prediction. Have these innovations been taken into consideration for smart cities at an implementational level?

From the analysis of their vision statements, it is clear that half of the top 20 smart cities overlook sub-dimensions of health, literacy, youth, as well as the vulnerable section of the society (women, differently-abled citizens, seniors and children). This is a concerning oversight (D. Prasad, et al [5]). Only five of the smart cities have proposed to improve their market through the tech-industry using smart policy making. What measures should be taken to rectify this oversight?

It is evident that the smart environment dimension is not the core in any of the SCPs prioritised for smart city implementation in India (D. Prasad et al [5]). A striking contrast to this is the city of Oslo in Norway which features 3rd on global rankings of lists of smart cities. Its effort to address climate change and take concrete measures against it are a part of the reason, with aim to cut as much as 95% of its carbon emissions by 2030. With climate change set to adversely affect India, it is necessary for Indian Smart Cities to take prudent measures to reduce its effects. Infrastructural and Technical limitations are key to lack of climate resilience in Indian Smart Cities.

Lasty, while surveillance in Smart Cities in India is still in its infancy, there is a lack of clear ethical guidelines in the CCTV surveillance mechanisms and other data-privacy surveillance mechanisms employed. Cities must figure out a solution to survey citizens while also avoiding infringement and invasion of their data privacy. This can lead to a moral dilemma and, left unresolved, lead these smart cities to experience the hazards of a ‘surveillance culture’ (Lyon et al [23]).

5. Conclusion

We have explored IT solutions either proposed or implemented in the top 3 Smart Cities in India i.e. Bhubaneshwar, Pune and Jaipur respectively. These solutions are unique to the needs of the citizens of each specific city. The paper details some of the interesting projects in the field of IT existing in these cities and elaborates on their implementation details.

While powerful IT solutions are being implemented all across India as a part of the Smart Cities Mission, much progress is left to be desired, especially on conducting a comparative analysis globally. We explore shortcomings of Indian Smart Cities and delve into the causes leading up to it. We cover the key reasons existing in current research literature which leads to technological limitations in Indian Smart Cities.

We also open a variety of key discussions regarding how smart cities in India must proceed. These are explored from a technological lens. We discuss the projects Indian smart cities can draw inspiration from and emulsify. We also look at a wide collection of sectors which can benefit from IT but which have been overlooked in the vision for Indian Smart Cities.

We hope this paper can act as a balanced reference for individuals and teams embarking upon projects related to the IT field to aid in the development of Indian Smart Cities. We make a sincere effort to present in-depth the technological angle of this issue, so that it can assist policymakers and economists exploring this issue.
6. References


Aggression and Resilience in relation to Parenting Styles

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Abstract- The purpose of the study is to see the link between two different styles of parenting with aggression and resilience in present adolescents. With the changing world and lifestyle the ways of rearing a child is also changing. Child’s advancement in his personality, attitude, and behavior are also dependent on the parents and can influence the aggressive behavior and the resilience or how successfully they are able to adapt in the difficult circumstances. For the study, 120 participants from different schools (Dehradun, India) were selected through convenience sampling technique. Tools used in the study were Adolescent Parenting Attitude Four Factor Questionnaire (APA-FFQ), Buss and Perry Aggression Questionnaire and Brief Resilience Scale. It was a quantitative study and t-test was used to analyze the data. The result indicated that both authoritative and authoritarian styles of rearing had an impact on the child’s aggression and that aggression was high in authoritarian style of parenting. Furthermore, there was no impact of both the parenting styles on resilience of a child. It was concluded that two different styles of rearing have an impact on aggression but not on resilience of a child.

Index Terms- Parenting styles, aggression, resilience, adolescence

I. INTRODUCTION

Throughout history, we have seen that child’s advancement in his personality, attitude, and behavior are dependent on the type of parenting also. Parenting is a complicated task; it is the method the parents engage in to raise the child. When a child is born, mostly he sees is his parents and only through his observation he develops a feeling of trust and security. With the passing years, the fast-paced society, and changing lifestyles, the parent-child relationship is also changing. Parenting styles are linked to how the parents themselves were born and raised, their culture, society, and their exposure to different situations in life that in turn affects the child emotionally, socially, physically, intellectually, and spiritually. Parenting styles affect a child’s negative emotions and problematic behavior from an early age of 3 years by mothers practicing authoritative parenting styles (Paulussen-Hoogeboom, Stams, Hermanns, Peetsma, & Wittenboer, 2008). According to a sample of US adults parenting styles of high control by mothers have been linked to various mental disorders such as depression, eating, behavioral, attention-deficit/hyperactivity disorder (ADHD), anxiety disorders, and substance abuse (Eun, Pakarian, & Merikangas, 2018).

II. PARENTING

Parenting can be elucidated as an act of nurturing or rearing a child in all aspects of socio-emotional, physical and cognitive development since a child is born as a baby till he reaches a level of maturity.

Types of Parenting

Baumrind (as cited in parenting for brain, 2020) gave three types of parenting styles and Maccoby and Martin (as cited in parenting for brain, 2020) explained the types with bi-dimensional approach i.e., Authoritarian style where the parent has strict rules and high expectation from the child. The autonomy of the child is rejected which might result in the child being more aggressive, with low self-esteem, less creativity, etc. This style is often associated with adolescents developing conduct disorders. A research was conducted to see correlation of authoritarian mothers and their adolescents developing conduct disorder. The result showed that mother’s psychological distress and socioeconomic factors contribute to develop conduct disorders in child and a linear correlation was found between the two variables (Thompson, Hollis, & Richards†, 2013). The Authoritative style also has high expectations from the child, but they also give independence to the child to be themselves. This style of parenting is proven to be the finest parenting style when compared to other three. It leads the child to grow in a good environment where he can speak his thoughts clearly with the parents and parents also has autonomy, guidelines, and rules that the child must follow at any cost. A study was done on 6,400 American adolescents that proved that the authoritarian style of parenting guides the adolescents and result in better school performance and engagement in school activities (Steinberg, Lamborn, Dornbusch, & Darling, 1992). Other than the above mentioned raring styles there are two more raring styles: Permissive style where the parent is overly lenient, they do set rules for the child, but they hardly follow them strictly, and Uninvolved style where the parents do not care about the child they are cold, neglectful and unresponsive to the child’s needs. Earlier the parents used to adopt the authoritarian parenting style, however, the trends are changing with the passing years, where greater autonomy is given to the child for private self-expression in activities such as everyday routine, physical outlook, regard and disregard for authority but also minimum freedom given by parents (Rutherfort, 2009).

Aggression

Aggression is a strong emotion that affects our mood and situation in a variety of cases. American Psychological Association (APA) dictionary of psychology defines aggression as
to harm a person physically or psychologically and when aggression is to attain a goal or inflict intentional injury it is called hostile aggression. It can be aggressive or instrumental aggression (reaching the goal) or reactive and emotional aggression (the emotional response to the target person).

**Social Learning Theory**

Bandura (1973) said that adolescents learn to act impulsive and violent through rewards and punishments, and through observing their models or parents. If a person has been exposed to violence and aggression throughout their life, they are more likely to think it’s accepted in their society to be aggressive. Various biological, psychological, and behavioral aggressive factors in childhood related to aggressive behavior in childhood usually increase the likelihood of adolescents developing antisocial behavior in their lives of adolescents and adults (Hill, 2002). Bandura (1997) came up with the social learning theory which was based on the early school of behaviorism; classical conditioning and operant conditioning.

There are four other kinds of aggression i.e., physical aggression which is caused by hitting a person, verbal aggression that is characterized by communicating insulting words or criticizing the other person verbally, hostility when you refuse to accept the attitudes of the other person and have a pessimistic view about them and anger when a person has strong animosity regarding someone.

**Resilience**

With increased stress and anxiety in today’s world, the adolescents face a lot of negative emotions (anger, fear, disgust, etc.) making it hard for them to be resilient to external factors in the environment. Resilience represents skills of stress coping ability in difficult situations, relationships, etc. American Psychological Association (APA) (2012) help center explains resilience as the phenomenon of reshaping and adjusting successfully in facing distress, misfortune, torment and setback. It involves overcoming and reflecting from difficult circumstances. Our genetics and the environment serve as important factors in building resilience skills. Kim-Cohen, Moffitt, Caspi, & Taylor (2004) suggested that when 1,116 five-year-old twin pairs were faced with socio-economic distress, factors such as mother’s warmth, stimulating activities and a child’s outgoing personality all encourage positive adjustment. Furthermore, it stated that both nature and nurture have important role to play along with protective factors in the development of resilience and are influenced by the same. Resilience is seen as a skill and can be acquired and built with time by encouraging positive thinking, practicing on building emotional intelligence, knowing your strength and weaknesses and working to improve them, maintaining a social connection with people, working on one’s coping skills. Ken Ginsburg gave 7Cs to build the resilience which are: Competence, Confidence, Connection, Character, Control, Contribution, and Coping (Hurley, 2019)

**Types of Resilience**

Hurley, (2019) has categorized the types of resilience into four categories:

- **Psychological resilience** - the ability to work with everyday stress, adapt to the environment when faced with any adversity.
- **Physical resilience** - it refers to how quickly a person’s body recovers and adapts from any injury or accident that they faced. Physically resilient people coping styles might include lots of exercise and meditation.
- **Emotional resilience** - it refers to how well an individual works with his emotions when faced with adverse situations. Emotionally resilient people are more self-aware and are high on emotional intelligence.
- **Community resilience** - it suggest the ability of a community or a group together to deal with various adversities like natural disasters, economic downfall, etc.

**Adolescence**

Adolescence is a time of an individual that falls somewhere between childhood and adulthood. It is somewhere when a child is around 13-19 years. Various factors contribute in the development of an adolescent like social and emotional aspect where adolescent understands the people and their emotions around him, the way the adolescent is treated in the family and his environment, the nutrition that his body gets to work well, the socio-economic status the family has, the education and learning that he adopts, etc. During this crucial stage of life adolescents may not agree with the parents and might have different beliefs. A study done on adolescents and parents to see the parental authority and the parenting styles suggest that they both see themselves differently; adolescents perceived their parents being more permissive and authoritarian and parents viewed themselves as being more authoritative. Also, suggesting that both the authority and styles of parenting were because of emotional autonomy and conflict between parent and adolescents (Smetana, 1995).

Adolescents’ period is also interrelated to psychopathic and antisocial behavior that they learn from observing their parents and environment. (Silva & Statin, 2016) did a study using the multiple regressions to see the relation between parenting and psychopathy on children and mothers. The results showed a linear interaction between the same.

**III. Literature review**

Talking about the rearing styles various factors can affect the child’s experiences and the most part of development. Aggression and emotions can be learned through watching their parents or older people that they admire or the environment they are raised in. Llorca, Richaud, & Malonda, (2017) did a cross-sectional study to see the effects of styles of parenting on pro-social and behavior inclined towards aggression through factors of empathy and stability of emotions in offenders and adolescents who were not involved in any crime in Valencia. Results showed that the variable of emotion acted as intermediate in adolescents who were not involved in crime, but in offender adolescents support and negligence had a direct effect on behavior inclined towards aggression in a negative way and in contrast positively affected pro social behavior and of permissiveness on pro-social behavior in a negative way. Another study done by Llorca-Mestre, Samper-García, Malonda-Vidal, & Cortés-Tomás, (2017) observed role of various type of rearing by parents and attachment towards peers.
and whether it predict emotional instability in adolescents with variables such as anger, empathy and ways to cope with anger. The result was examined separately for males and females through regression and showed that parenting styles and peer attachment was significantly predicting the emotional instability in adolescents. The authoritative style of rearing brings a good result and children are less aggressive. De la Torre-Cruz, García-Linares, & Casanova-Arias, (2014)did a study to analyze the physical and verbal aggression in adolescents shown towards their friends with the styles of parenting of not just the mothers’, but also the fathers’. Results indicated an authoritative style of parenting by various parents showed scores that were low in aggressive behavior as compared to the parents who practiced an authoritarian style of rearing. There was also seen a difference in gender (males) being high on aggression than girls.

When talking about different rearing styles and taking them individually it is seen that the harsh or the Authoritarian parenting can make a child grown up to more aggressive than other styles of parenting. In the study by Chang, Schwartz, Dodge,& Mcbride-Chang, (2003) who created a model to see the role of emotional regulation in concerning harsh parenting (direct and indirect) and how all of it effects child aggression in school. The sample was 325 Chinese adolescents. The result showed that mothers’ harsh parenting affected both the genders, where as fathers’ harsh parenting style affected just the male adolescents and had stronger affect on child’s aggression. Strict parenting adopted by mothers’ had an impact on the child’s emotion stability more when compared with strict parenting adopted by fathers’. The study also suggested that negative emotions serve as precipitating factor leading to family anxiety and problem in adjusting for a child. Similar study done by Azimi, Vaziri, & Kashani, (2012) studied out to see the connection in mothers’ side of parenting style and aggression that forms the behavior of the child with sample of 380 high school students (males and females) of Tehran. The result showed that the authoritarian style of rearing had favorable impact and it formed the behavior that is aggressive in a child. Furthermore, it was noted that authoritative and indulgent styles of rearing were not favorable and did not have a connection with aggression.

Various factors contribute to build our resilience, if a child has seen a lot of hardships in life he’ll be more resilient, but that is not always true it depends on the individually and the environment the child is raised up in Barnová, Tamášová,& Krásna, (2019) contemplated a paper to provide a review of literature on parents’ negative behavior and the role of resilience. The traditional desk research method was used. The conclusion suggested that neglect, domestic violence, abuse can affect the child negatively making him less resilient. Moreover, other protective factors such as schools, institutions, and support groups have a huge part to provide support like, developing their coping strategies and encouraging resilience in a child when dealing with risks. The different parenting styles bring up different resilient children Azarnioshan, Naderi, Shojaee, & Asghariganji, (2019) examined a study to see the intermediate role of resilience between different styles of parenting and how well they controlled their anger in secondary school of Iran. The result displayed parents who were involved in authoritative style of rearing adolescents had a favorable medium of controlling anger and resilience in child whereas the authoritarian style of rearing adolescents had an unfavorable medium of controlling anger and resilience in child. Also, resilience was a positive medium for aggression. A similar study done by Kritzas, & Grobler, (2005) was conducted on 360 English speaking adolescents to examine the connection between different styles of parenting and resilience. The authoritative style of parenting displayed a connection with resilience of white and black adolescents. Also, a favorable connection with fathers’ authoritarian style of parenting and coping strategies focused on our emotions in white learners. In contrast, the authoritarian style of parenting was connected to psychological disturbances.

IV. METHODOLOGY

Aim
To study the aggression and resilience of adolescents in relation to parenting styles.

Hypotheses
Considering the current sample and the variables certain hypotheses were made for the study:
1. There will be significant difference in the aggression level between authoritative parenting styles and authoritarian parenting styles.
2. There will be a significant difference in the resilience level between authoritative parenting styles and authoritarian parenting styles.

Variables
Aggression and resilience were the dependent variables that were studied across the independent variable that is parenting styles.

Sample and Sampling Technique
For the study, adolescents of 15-18 years were chosen from 2 different schools in Dehradun, India. The sample consisted of both boys and girls. The sample was selected by using convenience sampling technique where the adolescents who were easily available were included in the study.

Tools used
For measuring the aggression, resilience and parenting styles, three different questionnaires were used:
1. Adolescents Parenting Attitude Four Factor Questionnaire (APA_FFQ) by Shyny T.Y (2017)
2. The Buss and Perry Aggression Questionnaire (BPAQ) (1992)
3. The Brief Resilience Scale by Smith and Colleagues (2008)

Procedure
Initially 120 school going adolescents of 15-18 years of age were included in the sample. Out of the total 120 adolescents, 109 were taken into consideration who reported authoritarian and authoritative parenting styles. The remaining 11 who reported permissive and uninvolved parenting styles were rejected due to very little in number. The participants had their free will to participate in the study. They were contacted virtually and were asked to fill an online google form which consisted of total 75 questions from all three tools used in this research. The subjects were assured for the confidentiality of their names and responses.
The data was treated statistically by using Statistical Package for the Social Sciences (SPSS). In order to test the hypotheses independent t-test statistical device was used.

V. RESULTS AND DISCUSSIONS

The idea behind this research was to see the difference of aggression and resilience in adolescents with the authoritative and authoritarian type of rearing style.

Table 1: Independent t-test scores of Parenting Styles and Aggression

<table>
<thead>
<tr>
<th>Parenting Style</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authoritative</td>
<td>7</td>
<td>82.</td>
<td>15.</td>
<td>1.8</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Authoritarian</td>
<td>0</td>
<td>44.</td>
<td>61.</td>
<td>7</td>
<td>2.1</td>
<td>7</td>
</tr>
<tr>
<td>Authoritarian</td>
<td>3</td>
<td>89.</td>
<td>15.</td>
<td>2.5</td>
<td>3*</td>
<td>35</td>
</tr>
<tr>
<td>Authoritarian</td>
<td>9</td>
<td>73.</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05

An independent t-test was carried out to measure aggression in authoritative parenting style (n=70) and the authoritarian parenting style (n=39). There was a significant difference in the scores for authoritative style of parenting (M=82.44, SD=15.61) and authoritarian style of parenting (M=89.1, SD=15.73) with t (-2.13) =107, p=0.035. This suggests that the two parenting styles have a significant impact on aggression. Specifically, aggression is high in authoritarian style of parenting when compared with an authoritative style of parenting.

Results of the study explained that there was a distinction in the aggression level of the authoritative type of rearing used by parents and authoritarian type of rearing. Aggression was seen high in the authoritarian parenting style when compared with an authoritative parenting style. The authoritative type of rearing is considered the best parenting style mostly because the parents have a high demand from the child, but they also give the child their freedom to express themselves because of which the child becomes independent, cooperative, good decision-maker and high achiever whereas, in authoritarian parenting style the child cannot express himself and has to abide by the rules of authority. He may be high achiever but he might hide his emotions resulting in aggression. One reason for this could be that parents who are democratic or warm and form a secure attachment style in the early years of child development in which there is care, warmth, and love. They communicate with the child and are emotionally present for them. On the other hand authoritative parenting style form an insecure attachment style where the child might not be able to comprehend his emotions and is more dependent and reluctant on the parent for care. The child might grow up to be shy or rigid in expressing himself. Zeinali, Sharifi, Enayati, Asgari, & Pasha (2011) did research that highlighted authoritative and lenient styles of parenting were connected to form a secure attachment, high in monitoring and controlling emotions which declined the probability of addiction vulnerability, unlike authoritarian and neglectful parenting styles which were connected to anxious attachment style, low in self-regulation and increased probability of addiction susceptibility.

The other reason why adolescents experiencing authoritarian parenting style are more aggressive can be because these adolescents don’t have clear self-concept and self-esteem. After all, their parents use coercive methods to deal with the child, they force them to act under what is right to themselves because of which child gets confused and becomes dependent on the parents on how to behave. They are cold-hearted, cruel, and harsh on the child with no positive encouragement to motivate the child to do something. They become impatient and cannot engross themselves fully in a task which might make them frustrated making them more vulnerable to anxiety, depression, or any other mental disorder. While, authoritative parenting style adolescents have a clear concept and good emotional understanding, empathy, they know how to manage their life’s problems more patiently and they are more likely to preserve in the task that’s assigned to them. Rather than getting frustrated they channelize all their potential to something they feel they are good at, explaining why they may be less aggressive and less anxious or stressed. An academic work to perceive the impact of the three parenting styles on a sense of self, mental health, and standard of living on adolescents the result showcased the authoritative style of parenting had a positive impact on adolescents as they had better sense of self and self-worth, a better standard of living and less mental health problems when compared with authoritarian and permissive parenting style. (Nairaki & Rahimi, 2013)

Table 2: Independent t-test scores of Parenting Styles and Resilience

<table>
<thead>
<tr>
<th>Parenting Style</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resilience</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authoritative</td>
<td>7</td>
<td>3.0</td>
<td>0.5</td>
<td>0.0</td>
<td>0.53</td>
<td>10</td>
</tr>
<tr>
<td>Authoritarian</td>
<td>8</td>
<td>5</td>
<td>7</td>
<td>3*</td>
<td>7</td>
<td>95</td>
</tr>
<tr>
<td>Authoritarian</td>
<td>3</td>
<td>0.7</td>
<td>1.1</td>
<td>0.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.05

An independent t-test was carried out to measure resilience in the authoritative style of parenting (n=70) and authoritarian style of parenting (n=39). There was no significant difference in the scores for authoritative parenting style (M=3.08, SD=0.55) and authoritarian parenting style (M=3.01, SD=0.71) with t (0.533) =107, p=0.595. This suggests that the two parenting styles do not significantly impact resilience of the adolescents.

Resilience is a practiced skill that develops overtime and helps the individual to tackle various difficult circumstances. Both, authoritarian and authoritative parenting styles did not affect the resilience level of the adolescents. One possible reason for this could be the other environmental factors such as increased technological advancement and the use of smartphones and screens. That can act as a constant distraction, make a person sleep deprived. Various studies propose the exposure to blue screens can result in lower melatonin production, hamper our eyes, interrupting circadian rhythm, and results in poor sleep causing the individual to be less resilient and high in anxiety. The digital era has a lot of impact on our work-life balance and reduced
connection with parents, friends, and romantic partners. Furthermore, we face the fear of missing out and often compare ourselves with other individuals (Harrison & Lucassen, 2019).

Other reason for the child to not be resilient can be because both parents of authoritative parenting and authoritarian parenting styles strive for high expectations from the child meaning they strive for the child to be a perfectionist and excel in his field which might make a child feel less motivated and he might even get overwhelmed and stressed when he’s not able to achieve great heights that their parents want to make them less resilient in dealing with academics. Klibert et. al. (2014) did a study that highlighted the relation among perfectionism, resilience, and distress. The result showed that resilience played a mediating role between distress and prescribed perfectionism.

On the bases of the discussion of results, there are number of things which can come up as suggestions to build a better relationship between children and their parents. The family can consult a professional such as a psychologist who deals with problematic family relationships, or those having difficulty to adjust in the society in order to resolve related issues. The psychologist can help the parents in practicing the right ways of parenting and build an environment in which the child can flourish. They can also help the adolescents release their frustrations through counseling and therapeutic interventions so that they become less aggressive and build more resilience.

VI. CONCLUSION

It was concluded that there was a significant difference in levels of aggression in adolescents who reported authoritative and authoritarian styles of rearing and aggression was found more in authoritarian parenting style when compared with authoritative parenting style. Contrarily, there was no significant difference in the resilience level of authoritative and authoritarian styles of rearing. The results of the study indicate that there is a need to deal with issues like problematic family relationship, maladjustments, frustrations etc. by consulting the related professionals.

VII. LIMITATIONS AND SUGGESTIONS

There are number of limitations observed in this study for which suitable suggestions have been provided. First of all, the present study focused on just two parenting styles i.e. authoritarian and authoritative. Secondly, the study did not look at any other demographical factor other than the age of the adolescents. Further, the sample size was small and limited schools were included in the study and the study was done using online google forms only. On the bases of limitations observed, it is suggested that including permissive and uninvolved styles of rearing would get us more representative results. The results might have been more representative of the population if the subjects would have been contacted physically, from more number of schools and if wider demographical factors were included such as socio-economic-status, areas, etc. It is also suggested that the study can be replicated on children and young adult.

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AUTHORS

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Traditional and modern beekeeping practices in the center of Côte d'Ivoire: the case of the western part of Yamoussoukro

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Abstract- This study focuses on the evaluation of different beekeeping practices and the establishment of the beekeeping calendar in the rural western zone of Yamoussoukro in central Côte d’Ivoire. For this purpose, an ethnoapicultural survey based on a questionnaire was conducted among honey hunters and honey producers in this zone. The results reveal two types of beekeeping practices. The first is hunting or honey gathering which is a traditional practice, has a negative impact on the environment. The second is the modern practice of using modern hives to keep bees and using bee suits for honey collection. The modern practice is hygienic and has a positive impact on the environment. It also has a positive impact on the quality and quantity of honey. Annual honey production is on average 2.83 litres per natural hive and 12 litres per modern hive. The honey flow periods are from mid-August to mid-September and from mid-December to May. The dearth periods are from mid-September to mid-December and from June to mid-August. Honey production is a significant potential source of income for the rural population. Lack of maintenance or poor maintenance of hives leads to bees deserting the hives. This work is a contribution to the knowledge of honey production in Côte d’Ivoire and to the promotion of modern practice, which is still not very widespread.

Index Terms- Beekeeping, traditional, modern, gathering, Côte d’Ivoire.

I. INTRODUCTION

Beekeeping is a science of raising and caring for bees to obtain honey, wax, pollen and royal jelly from their directed labor [1]. Beekeeping constitutes a positive externality for the environment and biodiversity [2]. Indeed, its main utility is the pollination by bees of the flowers of crops and market gardeners in general and particularly those of plants that require cross-pollination [3]. Initially based on harvesting natural production, beekeeping has gradually evolved towards the use of traditional hives and more recently of modern mobile frames [4]. Modern beekeeping is popularized in North Africa [5], the traditional practice is also widespread in sub-Saharan Africa in countries such as Senegal [6], Burkina Faso [7], Benin [8] and Cameroon [9]. Beekeeping production is mainly oriented towards honey in African countries and the quantity produced does not cover domestic demand [10]. Today, rural populations are interested in beekeeping, which appears to be one of the interesting alternatives for reducing poverty [4].

In Côte d’Ivoire, the work already carried out concerns the production, gathering and marketing of honey in Katiola [11], in Yamoussoukro [12]; the melliferous flora near the village of Soungassou [13] and to the east of the town of Yamoussoukro [14]. The major Ivorian honey producing areas are the center and the north. Indeed, the central region of Côte d’Ivoire, which is characterized by an abundant and very diverse flora, is favorable to beekeeping activity. In addition, in the Baoulé villages, in the center of the Ivory Coast, in addition to the natural vegetation, the large cocoa, coffee, rubber and papaya plantations constitute enormous honey potential. But to date, studies on the types of beekeeping practices common in Côte d’Ivoire and data on the different honey production areas are challenges for the Ivorian beekeeping sector. In this context, all the themes on the production of Ivorian honey are to be considered. This is why an assessment of the Ivorian beekeeping sector is a prerequisite for proposing effective methods of improving honey productivity in the country. The objective of this study is to assess the different beekeeping practices and to establish the beekeeping calendar for the Yamoussoukro district.

II. MATERIALS AND METHODS

II.1. Presentation of the study environment

Figure 1 shows the map locating the study area in Côte d’Ivoire. The District of Yamoussoukro is located in the center of the Ivory Coast, precisely between 06° 7’ and 07° 8’ North latitude and between 04° 6’ and 05° 6’ West longitude. It covers an area of 3,500 km². The District of Yamoussoukro is an administrative entity that includes two municipalities: Yamoussoukro and Kossou [15]. It is bounded to the north by the department of Tiébissou, to the south by the department of Oumé, to the east by the department of Dimbokro and to the west by the region of Marahoué with the departments of Sinfra and Bouaflé. The study was carried out in the western part of Yamoussoukro, before the Marahoué region. The relief of the Yamoussoukro District is generally made up of plains and plateaus. Its soil rests on vast granite massifs of metamorphic and schistous rocks [16].

The District of Yamoussoukro belongs to the mesophilic sector of the Guinean domain [17]. It is subject to a subequatorial climate characterized by a rainy season from March to October and a dry season from November to February [18]. The vegetation of the District of Yamoussoukro is characterized by a mosaic of Guinean savannas and dense humid semi-deciduous forests [19].
II.2. Data gathering

An ethno-beekeeping survey was carried out among honey producers in the villages around the Yamoussoukro - Bouaflé axis, before the Marahoué region. The process consisted of two stages. The first consisted of conducting interviews with beekeepers in villages and camps, with questionnaires on the type of beekeeping practices, the quantity of honey produced, the impact of different beekeeping practices on the quality of honey and the environment, periods of honey and food shortages, and the health of the hives. The second step consisted of a direct field observation of the apiaries in the company of beekeepers with the aim of verifying certain information, in particular that relating to the environment of the apiary and the different honey harvesting methods.

The people surveyed are producers who harvested honey at least once over the period 2016-2018 and who marketed at least part of their production. The query was done at random. The approach used is the semi-structured interview [20].

II.3. Data analysis

The data collected was coded for frequency analysis with Microsoft office Excel 2007 software and Sphinx plus2. For a given parameter, its frequency is the ratio expressed as a percentage of the number of honey producers who recognized this parameter by the total number of people surveyed [21].

We did a Multiple Correspondence Analysis (MCA) in order to perceive the relationships between the type of beekeepers and their harvesting equipment as well as their impacts on the environment and the quality of honey. Sphinx plus2 made it possible to take into account the harvesting equipment used by beekeepers.

The increase or decrease in the amount of honey from one year to another is calculated by:

- the difference in quantity (dq) which is the subtraction of the smallest annual quantity (p) from the large annual quantity (g)

\[ dq = g - p \] (1)

- the proportion of quantity (pq) which is the ratio of the large annual quantity (g) to the small annual quantity (p)
The total quantity of honey produced in 3 years \( (Q_t) \) is obtained by adding the quantities of all beekeepers in 3 years \( (R_p) \).

\[
Q_t = \sum R_p
\]  

The months of honey flow and the months of famine made it possible to establish the beekeeping calendar for the study area.

### III. RESULTS

The responses obtained were integrated into a crosstab to carry out an MCA in order to establish any relationships that may exist between the different factors. These are: the types of producers (traditional and modern), harvesting equipment (fire, machete, ax, water extracted from cassava paste, eggplant leaves, tobacco and water. simple) and the impact of different harvesting methods (negative or positive). A factor map presented in Figure 2 is obtained at the end of this analysis. The results of the map present two axes that contribute 79.99% to the establishment of the existing relationships between the different factors. Harvesting materials (tobacco, plain water, water extracted from cassava paste and eggplant leaves) contribute 91.67% to the formation of axis 1 while traditional producers, the impact (negative) and harvesting materials (fire, machete and ax) contribute 32.95% to the formation of axis 2. Axis 2 alone contributes 60%. Figure 2 makes it possible to distinguish 2 groups:

#### III.1. First group

It is made up of traditional producers, their harvesting equipment and the impact of their harvesting method (Figure 2). The majority of these producers use fire, machetes, axes (Figure 3) to be able to harvest their honey. However, some use the liquids extracted from cassava paste and eggplant leaves. Others take tobacco powder mixed with tap, well or creek water. Honey pickers brush themselves with these extracts to ward off bees. The water is used to spray the bees to make them immobile and facilitate harvesting with bare hands. Still others spray bees with tobacco to achieve the same effect. The honey is extracted by pressing the honeycombs by hand. Furthermore, this ACM analysis shows that traditional beekeeping has a negative impact on the environment (Figure 4) and the quality of honey.

#### III.2. Second group

It includes all modern beekeepers, their harvesting equipment and the impact of their harvesting method (Figure 2). All modern beekeepers use a beekeeping suit (beekeeping outfit and gloves) and appropriate equipment (bee brush, smoker, knife and torch) for harvesting honey. Modern honey extraction is done by opening the lids of ripe honey and cakes by scraping the cells with a knife. Modern beekeeping technology has a positive impact on the environment and the quality of honey.

#### III.3. Conservation

All of the honey collectors surveyed store their honey in buckets and use the glass bottles as packaging material for sale. They also estimate the duration of consumption of their honey at 1 year. Modern beekeepers store their honey in opaque 20 liter cans. They use the opaque half liter (1/2 L) and one liter (1 L) cans for sale. The latter believe that their honey remains edible for up to 3 years after harvest.
Figure 2. Relationship between types of beekeepers, harvesting equipment and the impact of their harvesting methods

fmh: fire, machete, ax; eafas: water extracted from cassava paste, eggplant leaves; tes: tobacco, water; ca: beekeeping combination
**Figure 3.** Traditional honey harvesting technique (1 and 2)
A: 3 month old honey, translucent; B: One year old golden brown honey; C: Brown or dark brown honey with a shelf life of 3
**III.4. Quantity of honey collected**

The quantity of honey produced during the period 2016-2018 is 2226 liters. The production varies according to the type of beekeeper, the type of hives and the years.

**III.4.1. Quantity from traditional production**

Traditional production varies depending on the year. In 2018, it was estimated at 493 liters. This quantity increased by 38 liters, i.e. 7.71% compared to 2017 (455 liters) and decreased by 17 liters, i.e. 3.45% compared to 2016 (510 liters) (Table 1). In 2018, the yields per natural hive were highly variable, ranging from one liter of honey per hive to 12 liters with an average yield of 2.83 liters / natural hive.

**III.4.2. Quantity from modern beekeeping**

Modern honey production is growing over the years. Thus, in 2018 it was estimated at 457 liters. It increased by 245 liters or 53.62% compared to the year 2017 (212 liters) and by 358 liters or 78.34% compared to the year 2016 (99 liters) (Table 2). In 2018, the average volume of honey produced by modern beekeepers is 76.17 liters. Yields per hive have been highly variable, ranging from 2 liters of honey per hive to around 16 liters with an average yield of 12 liters / modern hive.

<table>
<thead>
<tr>
<th>Table 2. Variation in the quantity of honey from 2016 to 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quantity (liters)</strong></td>
</tr>
<tr>
<td>In 2016</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td><strong>Type of producers</strong></td>
</tr>
<tr>
<td>Traditional</td>
</tr>
<tr>
<td>Modern</td>
</tr>
<tr>
<td><strong>Total/year</strong></td>
</tr>
<tr>
<td>609</td>
</tr>
<tr>
<td><strong>Total of 3 years</strong></td>
</tr>
<tr>
<td>2226</td>
</tr>
</tbody>
</table>

**III.5. Health status of hives**

Table 3 presents the factors causing the destruction and deterioration of the hives as well as the disappearance of the honey they contain. These anomalies influence the amount of honey produced in the hives. For honey hunters the main cause is the deserted hives.
As for modern beekeepers, three causes have been cited: first, the hive can be deserted, this is the case for 70% of registered hives. Then, it can be attacked by black ants (20%) and finally by false moth (10%). Of all declared natural hives, 69.98% were attacked. 14.89% of modern hives have suffered damage.

### Table 3: Different anomalies depending on the type of beekeeping

<table>
<thead>
<tr>
<th>Producers and beehives</th>
<th>Ants attack</th>
<th>Attack by false moth</th>
<th>Deserted beehive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of producers concerned</td>
<td>2</td>
<td>2</td>
<td>127</td>
</tr>
<tr>
<td>Honey hunters</td>
<td>0</td>
<td>0</td>
<td>121</td>
</tr>
<tr>
<td>Modern beekeepers</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Number of hives affected</td>
<td>7</td>
<td>3</td>
<td>422</td>
</tr>
<tr>
<td>Number of natural hives</td>
<td>5</td>
<td>2</td>
<td>415</td>
</tr>
<tr>
<td>Number of modern beehives</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>

### III.6. Beekeeping calendar

The survey data enabled a beekeeping calendar to be established. It presents an alternation of periods of honey production called periods of honey flow and times of breaks also called periods of famine, during which there is no honey production. Two periods of honey flow were identified in our study area. They are interspersed by two periods of food shortages (figure 5). In other words, in the Yamoussoukro region, honey is harvested twice in a year. These seasonal beekeeping periods are distributed as follows: a small period of honey flow from mid-August to mid-September; a small period of famine from mid-September to mid-December; a great period of honey from mid-December to May and a great period of famine from June to mid-August.

Modern beekeepers rely on the weight of the hives to determine the periods of honey flow.

Figure 5. Beekeeping calendar of the study area
IV. DISCUSSION

IV.1. Honey Harvesting Methods
The traditional beekeeping equipment and techniques (fire, water, tree felling, etc.) used in the District of Yamoussoukro are similar to those described in Burkina by Nombré [22] in Rwanda, by Romet [23], in Mali by Van-Der-woerd [24], in Morocco by Dambilon [25] and Schweitzer [26] and in Botswana by Kepalletswe [27]. The traditional harvest (use of fire, tobacco, water and liquid extracted from cassava paste, eggplant leaves) is harmful to the environment and causes massive death of bees either by burning, by drowning, either by poisoning. According to Kouassi et al. [11], traditional exploitation contributes to the degradation of the environment (cutting down trees to harvest honey, using bush fires, etc.). This very ancestral method should no longer be practiced. Indeed, from 16 million hectares at the end of the 19th century, the area of dense humid forests is estimated at 2.5 million ha at the end of the 20th century, and about 1.385 million ha at the beginning of the 21st century, with a deforestation rate of 1.86% per year [28]. This disorganized deforestation situation, which is dragging Côte d’Ivoire into an ecological impasse, shows that the country must supervise the wild harvest of honey.

The honey collected by honey hunters contains a lot of animal and plant debris. After the fire has passed, this honey is colloquially called "burnt honey". It mixes with debris from tree trunks and the remains of animals that visit natural hives. According to Nombré et al. [29], in addition to the earliness of the harvests, the quality of honey is still affected by the equipment used for collecting, extracting and storing honey. The traditional method results in a honey that does not escape the presence of plant debris (ashes) and animals (broods, dead bees). Such honey, even after skimming, loses some of its therapeutic and nutritional properties [30]. The presence of animal proteins (dead bees and broods) and plant debris in honey affects its longevity. Therefore, the duration of consumption of honey by hunters and gatherers does not exceed 1 year.

On the other hand, modern practice which is more respectful of the environment should be encouraged. Cakes of ripe honey, carefully sorted and stored in opaque containers (canaries, gourds and wooden containers), retain all their therapeutic and nutritional properties for a long time [22]. Honey harvested by the modern method can remain edible for up to 3 years. This result is comparable to that of Swiss beekeepers who estimate the minimum shelf life of honey, at 3 years, when the honey is in good conditions [31].

Modern beekeepers, caring about bee life and their environment, use harvesting techniques that protect bees. In addition, they know that bees feed on their honey and stock up for times of famine due to lack of nectar. As a result, beekeepers leave some of the honey in the hive to ensure the survival of the bees. According to Tsafack et al. [32], the modern techniques used make it possible to make the apiary more profitable in order to only have strong colonies; in addition, the honey collected is clean and of excellent quality.

IV.2. Quantity of honey collected
The quantity of honey produced by traditional operators varies from year to year. To explain this, traditional producers invoke the lack of time to locate natural hives. The time allocated to traditional beekeeping is therefore almost negligible [11]; [12], because it is an activity that is done in parallel with their field work. The average volume of honey collected per natural hive is 2.83 liters. This low rate could be explained by the fact that natural hives are not maintained. They can be attacked by animals that love honey. To this end, [5] argues that the habitat of wild bees is rudimentary and exposed to the elements.

The amount of honey harvested by modern beekeepers is high and gradually increases over the years. Unlike traditional producers, modern beekeepers pay enough attention to beekeeping. The average volume of honey collected per modern beehive is 12 liters. This volume indicates a better yield compared to that of the production from the collection of honey. This average honey yield per modern hive is comparable to that of Manigri in Benin which is 11.2 ± 3.7 liters [21] and of the western highlands of Cameroon which is 10 liters [4]. The average annual volume of honey harvested (76.17 liters) by modern beekeepers in Yamoussoukro is lower than that obtained in beekeeping farms in North-West Cameroon which is 112.68 liters [32], and in the commune of Cobly in the northwest of Benin with 148.57 ± 77.01 liters [8]. Compared to the quantities of honey from modern producers in other countries, the low quantity of honey from modern beekeepers in the study area is explained by the fact that modern beekeeping is very recent in the region. Indeed, until 2014, the region had only one modern beekeeper.

IV.3. Health status of the hive
Black ants and false moth attack beehives because they are honey lovers. They attack the bees when the honey is ripe in the hive. False moth is a disease that attacks bee broods in the hive. The abandonment of hives by bees or deserted hives was the most reported by producers. The fragility of modern beehives is linked to the material used for their making: "white wood" or "red wood". The first being lighter and less resistant to insects than the second. Modern beekeepers use wax to brush their hives to preserve them from outside bodies. When this step is not done properly, the life span of the hive is reduced because it is exposed to ants. Modern beehives can also be attacked by other diseases. Kabar et al. [33] identified false moth, mycosis, calcified brood, nosemosis, attack by black ants as responsible for the destruction of the hive.
Unlike natural hives, the percentage of modern beehives attacked is low. This could be explained by their interview [34]. Natural hives are the most affected by the anomalies. According to Fird [34], natural beehives are the most exposed to the elements. These natural habitats of wild bee colonies, qualified as poorly compliant [35] are vulnerable. They can therefore be attacked by honey-loving insects and bee enemies. The reported desertion of natural hives could be due to the lack of training of honey collectors. Not keeping track of their hive, they cannot prevent these attacks which reach the hive. Then, climate change by disrupting the phenology of plant species, may have led to the displacement of bee colonies.

IV.4. Beekeeping calendar

The beekeeping calendar is made up of a succession of periods of food shortages and periods of honey. It gives indications on the favorable periods for rearing honey bees and the availability of honey in the region. It will allow anyone wishing to do beekeeping in the Yamoussoukro region to know the favorable periods for honey production. 8.5 months of honey flow were observed in the area. This result is comparable to that found by [22]. The latter capitalized on 7 months of honey flow in the Garango region in Burkina Faso. During the honey flow, beekeepers refer to the weights of the hives to choose the harvest time. In fact, the hives become heavier because of the products made by the bees: honey, wax and propolis. Indeed, according to Lavie [36], the weight of the hive is low during the period of scarcity, but high during the period of honey flow.

V. CONCLUSION

Observations made with honey producers in Yamoussoukro made it possible to identify two beekeeping practices: the very old traditional method and the recently introduced modern method. The first uses a material which, by negatively impacting the environment as well as the quality of honey, destroys bee colonies and their habitats, thus threatening ecosystems and biodiversity. The second is the most environmentally friendly and produces better quality honey in better quantities. In fact, the use of appropriate beekeeping techniques allows the proliferation of bee populations, which will help to perfect the pollination of the flowers in the region. The lack of maintenance or the bad maintenance of the hives leads to the deserting of the hives by the bees. The honey production periods run from mid-August to mid-September and from mid-December to May. It emerges from this study that the beekeeping sector in Yamoussoukro is not structured by official rules. The vegetation of the area constituting an important potential for beekeeping activities, the Ivorian beekeeping field requires the supervision of actors in order to improve the quality and quantity of honey produced while preserving the environment.

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Challenges Faced by ESL Teachers in Teaching English to the Students in Rural Schools: A Study Based on Five Rural Schools in the Kinniya Education Zone, Trincomalee, Sri Lanka

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ABSTRACT

Teaching English in rural schools has been a challenge for the most of the English as a Second Language and English as a Foreign Language teachers. Therefore, this study was carried out with the aim of investigating the challenges faced by the teachers in teaching English to the students in rural schools in the Kinniya Education Zone, Trincomalee. This study was a survey research, and both qualitative and quantitative methods were used for data collection. The research setting was five rural schools in the Kinniya Education Zone. 15 English teachers and 50 students from the selected schools were taken as sample population in this study. The data collection tools were questionnaire and interview. Based on the analysis of the data collection, the findings show that all the participants (15) encounter challenges in teaching English to the students in rural schools since many students show their dislike in learning English. Moreover, various factors such as poor parental support, lack of students’ and parents’ support, lack of learning/teaching materials at schools, both students’ and parents’ negative attitude towards learning English, lack of motivation and proper guidance, lack of interest in learning English, poor learning environment, poor family background and lower level of basic knowledge in English which contribute to the challenges faced by the teachers in teaching English at rural schools. These challenges and difficulties can be overcome when more focus is given to the students in primary stage to gain basic knowledge in English Language, several workshops, training programmes and motivational programmes about the importance of English are conducted for both parents and students and interest is created in learning English. Further, each and every school in rural setting should have possessed modern learning equipment like town schools and a language unit should be established with necessary equipment.

Index Terms: Challenges, English as a second language (ESL), Equipment, Kinniya Education Zone, Rural schools

01. INTRODUCTION

It is a well-known fact that English has been a universal language since it is spoken by many people as a first, second, or foreign language around the globe. In this sense, Dewi (2015) and Mydans (2007) state that English is used as a medium to interact with
people from different cultures, ethnic, and social backgrounds in the world. As a result, the English Language is widely used as a common code by multilingual people around the globe. It is taught as a first language (L1), a second language (L2), or a foreign language (FL) in every country. On the other hand, teaching English as a second language or foreign language has been a challenge for most of the English as a Second Language (ESL) or English as a Foreign Language (EFL) teachers around the world. Alrawashdeh & Al-zayed (2017) claims that teachers face different kinds of problems that make the process slow and rather weak. These problems put teachers into a dilemma in dealing with all the hardships in teaching students for the sake of their future. Similarly, English is taught as a second language in Sri Lanka since 1948. According to the educational curriculum of Sri Lanka, English is offered as the main subject in the school curriculum grades 1 to 13. As discussed above, several challenges and problems are faced by ESL teachers in teaching English. In particular, the teachers who perform their service at rural schools encounter several challenges and difficulties in their teaching process. Therefore, English Language Teaching seems to fail in rural schools. Many factors influence the failure such as the negative attitude of the students and parents in learning, poor learning environment, lack of sufficient learning/teaching materials, improper guidance and motivation, and insufficient qualified and trained teachers at rural schools. Students’ negative attitude in learning has been one of the major challenges for most of the ESL teachers in teaching English. In a similar study, Juan (2006) claims that the learners’ negative attitude toward English poses a great barrier for effective teaching. This negative attitude emanates from the fact that learners have limited competence in the language. Therefore, this current study was carried out to identify the challenges faced by ESL teachers in teaching English to the students in rural schools in Kinniya Education Zone, and the factors that contribute to the lower performance in English.

1.1 Statement of the problem

A universal fact accepted by the people that teaching English has been a challenge for ESL and EFL teachers in the countries where English is taught as a second or foreign language. Several research studies had been previously carried out investigating the challenges and difficulties faced by ESL/EFL teachers in teaching English. Similarly, In Sri Lanka, teaching English has been a challenge for most of the teachers. They encounter several difficulties in teaching English at schools and other educational institutions. As a result, English Language Teaching (ELT) seems to fail in Sri Lanka. Particularly, teaching English to students in rural schools is a major challenge for teachers. Likewise, Kinniya Education Zone is one of the education zones in Sri Lanka where 45% of the schools are located in rural settings. The ESL teachers who perform their teaching service at rural schools face several difficulties and challenges in their teaching process. Various factors contribute to the challenges and students’ lower performance in English.

1.2 Objectives of the Study

- To identify the challenges faced by ESL teachers in teaching English to the students in rural schools of Kinniya Education Zone
- To identify the factors which affect teaching and learning English at rural schools in the Kinniya Education Zone
- To suggest some remedies and recommendations overcome the challenges faced by the ESL teachers in teaching English to the students in rural schools and to uplift their English education

1.3 Hypotheses of the Study
English Language Teaching seems failure for most of the ESL teachers who perform their teaching service at rural schools. Both parents’ and students’ negative attitude is one of the major factors to the challenges and students’ lower performance in English. Students do not show their interest in learning English like showing interest in other subjects.

1.4 Limitations of the Study

Kinniya Education Zone consists of three education divisions and 66 schools. Out of the 66 schools, 30 schools are located in rural. In all 30 rural schools, ESL teachers face challenges in teaching English to the students. However, to limit this study, 12 schools were randomly selected to carry out this research. There are over 25 ESL teachers at the selected 12 schools. Out of them, 15 teachers were selected to collect their opinions by questionnaire. Moreover, over 3500 students are studying at the selected schools. 50 students from the 12 schools were randomly selected to limit this study.

1.5 Methodology

1.5.1 Research Design

This study was conducted with the aim of investigating the challenges and problems faced by ESL teachers in teaching English for rural schools’ students in Kinniya Education Zone. This study was a survey research, and both qualitative and quantitative methods were used for data collection. After the data collection procedure is over, the data were analyzed which was descriptive analysis.

1.5.2 Sample

The total population of this study focuses 3500 students and over 25 ESL teachers from 12 rural schools of the Kinniya Education Zone. The sample population of this study was 50 students and 12 ESL teachers.

1.5.3 Research Instruments

In this study, two research instruments were selected for data collection. They are questionnaire and interview. The first instrument was a questionnaire which consisted both close-ended and open ended questions. The questionnaire focused on collecting opinions among the ESL teachers regarding the challenges faced by the teachers in teaching English to the students at rural schools and factors which contribute to the challenges. The interview on the other hand was the second instrument which was used to collect opinions among the students regarding the interest in learning English, learning difficulties and factors which affect learning English.

1.5.4 Data collection and analysis

These instruments were used to collect both qualitative and quantitative data. The interview was used to qualitative data whereas the questionnaire was used to collect quantitative data. After the data collection is over, the data were analyzed statistically using graphs and tables which was descriptive analysis.

02. RESEARCH ELABORATIONS

Teaching English has been a significant problem among the ESL/EFL teachers around the world. Milon (2016) explains that the global distributions of English are often described in terms of three contexts such as English as a Native Language (ENL), English as
a Second Language (ESL) and English as a Foreign Language (EFL). Therefore, in each country, English Language is taught based on the English curriculum but teaching English seems challengeable for most of the teachers. Several previous studies regarding the problems and challenges encountered by ESL/EFL learners in teaching English had been carried out. Therefore, according to the review of previous studies, drawing from a more recent study by Ngwaru & Opoku-Amankwa (2010), it is arguable that learners who are socioeconomically disadvantaged face significant consequences in learning. This include absenteeism from school because of lack of school necessities, taking care of the sibling as parents look for food and even doing petty jobs to supplement on the family income. Adding to this is the minimal parental involvement in children’s learning. According to their argument, poor parental attention is one of the factors which lead to the students’ lower performance in education, particularly performance in English Language learning. With regard to teaching English, Endriyati (2019) asserts that teaching English as a foreign language is a challenging task both in rural and urban areas. Teachers have to pay attention to the language skills of the students such as reading, writing, listening, and speaking. He further emphasizes that besides that, the teachers should help the technology, and encourages the students to have enthusiasm, good attitude, and motivation to learn English.

Moreover, with regard to the importance of English, Rajasekaran & Anburaj (2015) describe that importance of English today is something that can't be emphasized enough. It is as important as a graduation degree and knowledge of English can be something that stands between you and your dream. Despite, students in rural setting always fail to realize the value of English Language. They are not encouraged and they do not have sufficient facilities to learn English. Rajasekaran & Anburaj (2015) further claim that there is a choice to learn English to everyone in cities but when the rural areas are concerned, they are let alone. According to Rajasekaran & Anburaj (2015), cities have many institutions to learn English whereas rural areas do not have a scope of one institution. Therefore, the hospitality of the villages discourages the educators. Likewise there are many factors which contribute to the challenge and difficulties to teach English as well as to learn English. In this sense, according to Arroji (2016), he states some reasons for facing challenges to teach English for rural school students. They are; lack of clear-cut policy, lack of competent teachers, lack of understanding of aim, lack of exposure to the language, lack of suitable teaching aids and materials, lack of motivation and large Classes. Likewise, in the current study also, there are many factors which lead to failure of English Language Teaching (ELT) in rural settings. Moreover, a similar study had been carried out regarding the challenges in teaching English at both rural and urban schools. In this study, Endriyati et al (2019) conclude that there are some different challenges in teaching English at rural and urban schools. In rural schools, there are some challenges such as low motivation, the parents support, and lack of vocabulary. They further recommend that to overcome the problems of teaching English to the students in rural schools, the teachers should try to apply some methods in learning process, and make a good communication with the parents.

03. FINDINGS

This part concerns the findings of the data analysis. As far as the collection in concerned, the relevant data were collected using both questionnaire and interview based on the problem and hypotheses of this study. Accordingly, based on the analysis of data, the findings of the questionnaire show that a question was asked whether teaching English to the students in rural background is challengeable for ESL teachers, to which all 15 participants responded ‘yes’ on the other hand nobody responded ‘yes’. This has been the problem for most of the teachers in rural schools. Various factors contribute to the challenges faced by the teachers in teaching English at rural schools. They are: lack of students’ support, students’ negative attitude in learning, poverty, poor parental attention, lack of learning equipment and more. Moreover, the participants were asked whether their students are interested in learning English, to which 10 of the participants responded ‘no’ whereas 5 of the participants responded ‘yes’. Although most of the students have lack
of interest in learning English, some of the students are interested in learning English. If they are concerned, they are interested in learning all the subjects including English Language. Similarly, the participants were asked whether their students are supportive and attentive in their teaching process in the classroom, to which 9 of the participants responded ‘no’ and 6 of the participants responded ‘yes’. This is one of the important factors for finding challenges in teaching. When the students show negative attitude, indeed, teaching and learning process will be failure. In the next question, the participants were asked whether their school consists of enough teaching and learning equipment and facilities, to which 12 of the participants responded ‘no’ whereas 3 of the participants responded ‘no’. Due to lack of learning teaching equipment, both teachers and students face challenges in teaching and learning English. Always modern equipment like computers, multimedia, audio recorder etc. create an interest to the students and they make the students attentive.

Moreover, a question was asked with regard to attendance and participation in the classroom. The participants were asked whether the students attend school regularly, to which 10 participants responded ‘yes’ and 5 participants responded ‘no’. Students’ lack of participation is one of the factors which leads to face challenges in teaching English to the students. The next question was regarding parental support and interest in which the participants were asked whether the parents are interested in educating their children and are supportive for their learning. 9 of the participants responded ‘no’ while 6 of the participants responded ‘yes’. Based on the findings regarding parents’ support and interest, most of the parents in rural background were not supportive and interest in educating their children. The following table shows participants’ response (%) to the questions.

<table>
<thead>
<tr>
<th>No</th>
<th>Questions in the questionnaire</th>
<th>Participants’ percentage (%) for response</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Do you think that teaching English to the students in rural background is challengeable?</td>
<td>100%</td>
</tr>
<tr>
<td>02</td>
<td>Are your students interested in learning English?</td>
<td>34%</td>
</tr>
<tr>
<td>03</td>
<td>Do you think that your students are supportive and attentive in your teaching process in the classroom?</td>
<td>40%</td>
</tr>
<tr>
<td>04</td>
<td>Does your school consist of enough teaching and learning equipment and facilities?</td>
<td>20%</td>
</tr>
<tr>
<td>05</td>
<td>Do your students attend school regularly?</td>
<td>36%</td>
</tr>
<tr>
<td>06</td>
<td>Do you think that their parents are interested in educating their children and are supportive for their learning?</td>
<td>40%</td>
</tr>
</tbody>
</table>

Table 1 (Participants’ percentage for response to the questions)

Further, with regard to the factors which contribute to the challenges in teaching and learning English in rural setting, both students and teachers were asked about the factors through questionnaire and interview. The question was open-ended. Therefore, the
participants had given various factors which affect teaching and learning English in rural setting. Based on the response of the participants, the following table shows the findings.

<table>
<thead>
<tr>
<th>Factors affecting teaching English based on teachers’ response</th>
<th>Number of participants</th>
<th>Factors affecting learning English based on students’ response</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of students’ and parents’ support</td>
<td>12</td>
<td>Lack of motivation and proper guidance about learning English</td>
<td>32</td>
</tr>
<tr>
<td>Students’ negative attitude towards learning</td>
<td>13</td>
<td>Giving more importance to other subjects than English</td>
<td>38</td>
</tr>
<tr>
<td>Lack of interest in learning English</td>
<td>11</td>
<td>Lack of interest in learning English</td>
<td>34</td>
</tr>
<tr>
<td>Lack of motivation and proper guidance towards about learning English</td>
<td>12</td>
<td>Low level of basic knowledge in English Language</td>
<td>37</td>
</tr>
<tr>
<td>Environment and poor family background</td>
<td>13</td>
<td>Poor family background</td>
<td>35</td>
</tr>
<tr>
<td>Lack of sufficient learning/teaching materials at school</td>
<td>12</td>
<td>Lack of learning environment</td>
<td>37</td>
</tr>
</tbody>
</table>

**Table 2 (Factors affecting teaching and learning English in rural setting)**

04. CONCLUSION

Teaching English at rural school has been a challenge for a large number of ESL teachers in Sri Lanka. Similarly, the ESL teachers at rural schools in the Kinniya Education Zone, Trincomalee encounter a number of difficulties and challenges in teaching English. Therefore, this study was carried out with the aim of investigating the challenges faced by ESL teachers in teaching English to the students in rural schools. According to the findings of the data collection, this study can be concluded that all the participants (15) encounter challenges in teaching English to the students in rural schools since a large number of students are not interested in learning English. Moreover, the findings show that various factors which contribute to the challenges faced by the teachers in teaching English at rural schools. They are: poor parental support, lack of students’ and parents’ support, lack of learning/teaching materials at schools, both students’ and parents’ negative attitude towards learning, lack of motivation and proper guidance, lack of interest in learning English, poor learning environment, poor family background and low level of basic knowledge in English.

These challenges and difficulties can be overcome when the followings are implemented at rural schools in the Kinniya Education Zone. They are as follow:
More focus should be given to the students in primary stage to gain basic knowledge in English Language.

A number of workshops, training programmes and motivational programmes about the importance of English should be conducted for both parents and students and teachers should create an interest in learning English.

Each and every school in rural setting should have modern learning equipment like town schools and a language unit should be established with necessary equipment. The principal, Old Boys Association (OBA) and School Development Society (SDC) should take steps to collect funds from outsiders to establish the unit.

APPENDICES

Appendix A: Questionnaire

This questionnaire has been designed to collect the relevant information about the challenges and difficulties faced by the ESL teachers in teaching English to the students in rural schools for carrying out a research. Therefore, kindly and complete this questionnaire and provide your support to achieve the aim of this study. The information will be strictly treated confidential.

Select the suitable answer according to your point of view and underline.

Name ……………………… Current School ………………………

1. Which section are you teaching to?
   - Primary section
   - Junior Secondary section
   - Senior Secondary section (A/Level)

2. Do you think that teaching English to the students in rural background is challengeable?
   - Yes
   - No

3. Are your students interested in learning English?
   - Yes
   - No

4. Do you think that your students are supportive in your teaching process?
   - Yes
   - No

5. Does your school consist of enough teaching and learning equipment and facilities?
   - Yes
   - No

6. Do your students attend school regularly?
   - Yes
   - No
7. Do you think that their parents are interested in educating their children and are supportive for their learning?
   - Yes
   - No

8. What are the challenges and difficulties do you face in teaching English to the students in rural schools?

Appendix B: Interview

Followings are the interview questions given to the students.

1. What is your name?
2. Where do you come from?
3. Which school are you studying?
4. Which class are you in?
5. What is your father doing?
6. Are you interested to learn English?
7. Do you study English at home?
8. Do you go for English private classes?
9. Why do you show lower performance in English than other subjects?
10. How can you improve your English?

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Monitoring and Evaluation and Institutional Performance

A Case of Teacher Self Learning Academy Project on School’s Academic Performance in Bugesera District

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Abstract: The present study target was to investigate the impact of Project M&E on institutions’ performance from the view point of primary schools in Bugesera District. The project aims to improve learning outcomes for P5 and P6 pupils in 15 selected in Bugesera districts’ primary schools. It seeks to do this by enhancing teaching and learning process quality in P5 and P6 with methods of innovation and technology so as to increase the content and teaching methodology of language teacher self-academy project monitoring and evaluation and its impact on school performance was analyzed and compared, considering performance of students. The researcher adopted the descriptive survey design. The study population comprised 956 in total including 300 teachers, 15 head teachers, 15 SEO’s and 615 students of 15 primary schools in Bugesera district and 11 plan international officers. The researcher used simple randomly sampling to select the schools; hence 5 schools will be sampled. Simple Stratified sampling was used to categorize the sampled schools according to their zones and size. The researcher used the Yamane formula to determine the sample size of teachers, students and school administration, SEO’s and Plan International Officers. And at each school level, the teachers were purposively sampled. The author used the questionnaire and interview to collect data. Data was analysed using SPSS 16.0. This study concluded that was a significant positive correlation between project monitoring and evaluation of school’s activities and academic performance in English for P5&P6 (r=0.715). Based on the findings for this study, the researcher concluded that project monitoring and evaluation greatly influenced academic performance in schools and that the TSLA project implementation process needs to be monitored and evaluated to enhance more efficiency. This is because most of the respondents (81.7%) indicated that the teachers and students needs more resources for academic activities and TSLA should help them for their performance, lesson pan preparation, use of ICT and schemes of work, which are implementation practices of TSLA activities, increases academic performance in English. From the research findings the researcher made the following recommendations: Project Monitoring and evaluation help the institution to perform better especially primary and secondary schools so TSLA projects coordinators and plan international should influence more the TSLA activities in the schools to enhance students’ academic performance in Bugesera District. School management and SEO should audit every day activities to make follow up on TSLA’s activities to raise students’ academic performance.

Key Words: Monitoring: An evaluation: Academic’ Performance: Project, Rwanda

1. INTRODUCTION
Social system of people that is well organized and well managed to meet the required needs and to achieve a common goal is called an institution. It is a strategic organization of people brought together to achieve some specific purpose; applies to all organizations, for profit as well as not for profit institutions. Common characteristics of an institution include: goals, structure and people. To achieve its goal, people within an organization plan and design different projects in a structured way. A significant quantity of time, effort, and other resources go into the development and implementation of projects (Alain, 2011).

A project involves temporarily efforts that are targeted to make products, results or services which are unique in terms of creativity and innovation. It requires well organized activities to establish and operate an effective project. A set of activities are carried out by different people as planned and agreed upon by project managers and other project stakeholders like participants, implementers, decision-makers as well as donors. All project stakeholders perform several but different major functions. These functions enable them to create a positive work environment and to provide the opportunities and incentives. In

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many projects, “monitoring and evaluation” is one of the pillars that support them for effective performance. Even though project planning is very essential, if not done in logical ways, a project may not achieve its desired outputs within its given timeframe. The best tools to use to ensure that the project is running smoothly or not is monitoring and evaluation (Thimoty, 2009). Therefore, M&E is the main tool of management. Public institutions, private ones, civil societies, universities and research institutions should be aware of the effectiveness of their efforts, but the key question being asked is who must judge on the right basis and how to conduct M&E effectively (Alain, 2011).

Monitoring and evaluation is the best method to check the progress of a project and to ensure that what is being done can meet the achievements that are expected. However, monitoring and evaluation are different but also designed to make assessment to the achievement of organization. Monitoring is strategic and long process from the beginning to the end of the project implementation. Contrary evaluation is done at a specific time to check the level at which objectives have been achieved (Alain, 2011).

The primary function of M&E is to give directions on how the activities should be done. Interacting with suitable data which can be accessed into usable, timely and relevant statistical information is necessary in monitoring and evaluation as in turn leads to experience (Global Fund, 2003). A well monitoring and evaluation model looks at situational analysis, problem identification, objectives, activities, strategies, contributions, outputs, outcomes as well as the impact of the project. The Teacher self-learning Academy (TSLA) project M&E system will draw on Plan International’s Programme Accountability and Learning System (PALS) and tools and techniques specific to the innovation and designed to demonstrate both the success of the intervention and provide a strong evidence base for Plan and others to learn from the innovation.

At the level of activities and outputs, project monitoring will focus on measuring three main components of the innovation: the effectiveness of the ‘hardware’ (that is, the iPods, their usability, reliability and sustainability); the effectiveness of the ‘software’ (the audio-visual content itself, including its relevance and accessibility); and the effectiveness of the learning and reflection meetings. The effective M&E will bring about good impact on school’s performance in Bugesera District.

### Problem Statement

For organizational members especially managers who spend much efforts in order to achieve the organizational goal, good performance is a target for all community members. Many activities are carried out within an organization including setting goals, objectives and strategies, preparing plans, budget and forecasts, implementation, monitoring and evaluating performance, making corrective adjustments as well as performance review. These activities are done to ensure good performance of the organization. Plans without monitoring and evaluation leads to non-performance or ineffective performance.

Management and supervision of project activities is done as monitoring, with the purpose to improve the way the project is being implemented. It is continuous action to gather data on the implementation of the project activities. Evaluation to the success of the project in attaining its results should have monitored continuously (NSDS, 2007).

Monitoring and evaluation in many organizations are used as a tool by donors. Donors are eager to be informed on how the money is being used in that way the project managers do monitoring and evaluation to justify the use of money from donors. However, the role of monitoring and evaluation must be considered as for the organization or the project to find out whether it is meeting its objectives.

Despite the many projects that promote education, quality of education is still a big problem. The rapid expansion of Rwanda’s education system has come with many challenges. Quality of education remains the core challenge. It is in this line that Teacher –Self Academy project (TSLA) seeks to contribute in improving quality of education. The project will contribute to “effective teaching and learning” through the “use of appropriate technology in education” by supporting the professional development of teachers of English Language and Science to achieve improved learning outcomes for P5 and P6 students. In this case the Plan International implemented different projects in Bugesera district including TSLA Project. The TSLA project has many objectives for improving the teaching and learning process in primary schools. The long-term change that the initiative seeks to support is improved learning outcomes in English and Science for both girls and boys. The general objective of this research was to assess the TSLA Project Monitoring and evaluation on Schools’ academic Performance in Bugesera District. The specific objectives that guided this research were:

1. To analyze the effect of monitoring and evaluation on school’s academic performance in Bugesera District.
2. To examine the level of monitoring and evaluation to improve school’s academic performance in Bugesera District.
3. To evaluate the challenges facing project monitoring and evaluation in Teacher Self Learning Academy project (TSLA) in Bugesera District.

### 2. THEORETICAL LITERATURE

#### 2.1. Theoretical Literature

Monitoring and evaluation ensure the present and future best management of a project, institution or organization. This helps to put the connection among past, present and future (Kusek & Rist 2004). Both monitoring and evaluation’s aspects are needed to be accountable and decisive about the project (Valadez & Bamberger, 1994).

The donors budgeting the activities are supposed to control the process of monitoring and evaluation, this can be done by manager team and implementers. The validity of monitoring and evaluation written report depends on the seriousness, accountability and the experience of the evaluator (UNDP, Evaluation office, 2002).

According to UNDP in the book called Monitoring and Evaluation for Results, it helps to achieve effectively expected results. Performance is defined as progress towards and achievement of results. A good organization in any institution is the beginning of success as it leads to good results (Jody et al.,
The private sectors, the government institutions, non-governmental organisations are interested in good management for better results. As there is a great need of good achievement it is the reason why all institutions are interested in management and evaluation. Evolution in monitoring and evaluation has led to the shift from traditional to modern way of management. Any institution or organization can plan a project and implement it but the question that should be asked is “is it going to give us expected results”.

To be able to identify what works well and what does not work well monitoring and evaluation is necessary. They also indicate under what conditions in different focus areas lessons learned should be shared at a global level, through communities of practice or monitoring and evaluation groups, for example. This requires that staff record and share the lessons they have acquired with others (Cotton, 1988). The part of project design should also be prepared in monitoring and evaluation (Janice, 2019), this should involve the construction of the baseline data which describe the ‘what’ as a problem to be solved and the objectives to be achieved.

M&E enhance the effectiveness of organization by addressing the relationship between past, present and future should be done by monitoring and evaluation. M&E can identify what has been done well in the past and refer to it for the present and future.

Evaluation of comprehensive development framework of World Bank noted that monitoring and evaluation is the channel of most of donors to be aware of the progress of any financed project (World Bank, 2004). Monitoring and evaluation also brings changes in institutions. It deals with the overall achievement of the institutions mission (Crawford & Bryce, 2003). Monitoring and evaluation is most important management tool of a project because it facilitates how to find out the necessary information about project, it improves relationships among the people implementing it, it helps to identify in advance the challenges encountered in implementation and mitigate them, and it provides information that facilitate to make report (Crawford & Bryce, 2003).

2.1.2. Results-based monitoring and evaluation

Both government and non-governmental organisations need to make follow up in all planned project and policies (Holvoet & Renard, 2007). Nowadays all institutions including the government need change in people’s life, but the problem is to know whether this is being achieved. Are the programs, projects and policies leading to the expected results? How can prior failure become success? Is there any good starting baseline that is likely to lead us where we want to achieve? These are kinds of questions asked by all stakeholders all over the world and are busy striving to find answers to them.

Emphasis put on results caused the shift of emphasis on monitoring and evaluation. As the management of today looks at the final results rather than activities, is the reason why the monitoring and evaluation is also focused on achievement of results.

Generally, the monitoring and evaluation deals with the assessment and measurement of the performance of the project, program, and policies. Monitoring and evaluation is the tool to be aware of the products of the organization, how the beneficiaries enjoy them and how it brings change to the beneficiaries (Janice, 2019). To be aware of the favorable and unfavorable performance of an organization is very important for its improvement and all these are identified through monitoring and evaluation. For this reason, monitoring and evaluation are recognized as the tool used to ensure the performance and expected results in any institution (Suji, 2008).

Shortages of enough budget and high expectations of results from the customers requires organizations to provide high quality services. The control of civil society and sometimes parliaments put pressure to the institutions functioning. In the same way the agency of aid requires the indicators of how the aid provided used.

Two, monitoring and evaluation also induces learning. The data rooted from monitoring and evaluation gives the aid agencies clear information (DAC Working Party on Aid Evaluation, 2001). The planning in the future are guided by the past experience.

The use of monitoring and evaluation is recommendable to the performance and sustainability of the institution.

Generally the increment of emphasizing on results influenced the system of management in different organisations. Monitoring and evaluation ensures the participatory approach in the system and team work spirit, hardworking, and good use of resources (Kusek and Rist, 2004).

2.1.3. Challenges of Monitoring and Evaluation

Measuring impact and challenges may take long time, it may cost much and the results are debatable. However, even if such challenges are encountered, this does not mean that M&E should be neglected. It has to be done wisely with enough plan because if the challenges are not identified, there is no way to solve them (Callistus & Clinton, 2016).

Lack of time reserved to discuss changes and any other results from monitoring and evaluation is also another challenge (Fals, 2001). Most of the time monitoring and evaluation are given little consideration and stakeholders are not able to get information about the aided project (Peter & Hilary, 2001).

Challenging also is lack of adequate skills about how to implement the project, the ability to understand the objectives of the project toward achievement of them. M&E system in TSLA was mainly based on measuring three main components of the innovation: the effectiveness of the ‘hardware’ (that is, the iPods, their usability, reliability and sustainability); the effectiveness of the ‘software’ (the audio-visual content itself, including its relevance and accessibility); and the effectiveness of the learning and reflection meetings. M&E was challenged by teachers or implementers who do not know how to use the tools, students were not familiar with such teaching and learning system as well as inaccessibility of infrastructures like electricity in some schools. This method of teaching and learning helps in students’ success hence good school performance (Plan International, 2014).

2.1.4. Monitoring and evaluation in education

Quality of education remains a core challenge in Rwanda. The factors underlying this are: a) the majority of teachers do not have sufficient English language skills (REAP, 2009) b)
content: MINEDUC has identified poor skills in all areas of science and c) quality of education suffers from a lack of learner-centred methodologies.

Performance of schools is basically determined by teachers’ performance through professionalism, hardworking and preparation of lesson plans (Onyeachu, 1996). The impact of teachers on the students’ academic performance has become the common study of many researchers (Adediwuru & Tayo; Aduand Olatundum, 2007; Lockhead & dKomenan, 1988; Schacter & Thum, 2004; Starr, 2002). Poor teachers’ performance leads to poor students’ academic performance (Ofoegbu, 2004) and the poor materials at school are also the factor that can affect the students’ academic performance (Oredein, 2000).

2.2. Empirical Review

Because of the way the world is being globalized, all nations are striving to achieve international goals, to have political stability, security and faire for all the people so as to be most competitive among other countries in the world. Governments, parliaments, citizens, the private sector, the civil societies, the government, the non-governmental organizations, citizens and parliaments contribute to the better performance of the country. For this great demand of achievement, there is also demand for monitoring and evaluation.

The best tool that the government use to assess the achievement of the results is called monitoring and evaluation. As there is a need for the government to financial resources and hardworking there is also need for better results (Kuset & Rist, 2004). M&E facilitate to achieve good results. Specifically the aim of monitoring and evaluation is to measure the progress and take measure on the improvement of the implementation of project, policies or program. Like the emphasis part in the United Nations development programs, the need for ensuring the better performance leads to emphasis of monitoring and evaluation (Kafmann, 2001).

In traditional way M&E is there to evaluate the amount of inputs and the process of implementation. Nowadays there is a focus to any contributing factor for the results. Among those factors include the policy makers, the implementers, the available resources, as well as the stakeholders. The basic objectives of monitoring and evaluation are: one, enhancing learning development of organizations, two, ensuring informed decision making, three, practical accountability; four, capacity building of the country in all areas.

2.3. Theoretical Framework

This research was guided by Systems Theory by Ludwig von Bertalanffy (1972) who is often cited as the father of general systems theory. The entire thing is more than just one of its part, one part is determined by the whole thing, and the small parts are connected to make the whole and it cannot stand alone and resist so as to be functioning well all the members should work as a system where one sustain and support another to achieve the common goal (Churchman, 2011).

This study was based on theoretical model developed by Shavelson McDowell and Oakes (1987). This model presents education system in terms of inputs, processes and outputs monitoring and evaluation. The inputs in this study may include TESLA project which comprises of the INSET for school academic performance.

Monitoring is good when it gives warning about what is not going smoothly. It also involves comparing what is achieved and what is expected to be achieved. An example is when there is a comparison between the results and the objectives set to be achieved in certain period of time.

2.4. Conceptual Framework

![Conceptual framework](Figure 2.1: Conceptual framework)

Source: Researcher, (2019)

Monitoring and evaluation is measured in terms of the inputs usage within an institution. Inputs involves different resources needed like human, financial resources as well as materials. For any phenomenon, the independent variable is the cause while the dependent variable is the outcome. Our above case the independent variables were the four projects, M&E decisions’ implementation, Quality control for compliance, reporting non-compliance, Rework non-compliance that might cause the change of dependent variable which is the institutional performance.

The intervening variable are the variables that act as a catalyst between independent and dependent variables. These variables are ones that have a strong contingent effect on the independent variable and dependent variables relationship. This is how their
presence modifies the original relationship between the independent and the dependent variables. In this case, Politics, The socio-cultural factors, Technology, infrastructure, Stakeholders involvement will indicate institutions’ performance thus showing positive relationship between M&E and Performance.

3. RESEARCH METHODOLOGY
3.1. Research design and Population
De Vaus (2001) stated that research design is that plan and structural investigation aimed at finding out the solutions to the questions of research. A descriptive research design was used to examine the impact of monitoring and evaluation on institutions’ performance. It helps to specify clearly what the researcher wants to find out and the way of doing it. Under this research both quantitative and qualitative techniques and methods were used. According to Kothari (2004), the design must be rigid, must make enough provision for protection against bias and must maximize reliability.

Mugenda and Mugenda (2003) stated that population is totality of persons from which samples are taken for measurement. The total number of primary schools in Bugesera District is 79 schools. Among these the target population of 15 primary schools was used and totaled to 956 respondents made up of 15 head teachers, 300 teachers, 615 students, 11 Plan International staff and 15 sector educational officers (SEOs).

3.2. Sampling design
Williams (2009) defines a sample size as a number or objects in the sample. Sample itself is defined as all the population or case selected to take part in the research study. The researcher chose the zone purposively and uses simple randomly sampling to select the schools in Bugesera District. Stratified sampling was used to select school administration, teachers and students. Stratified sampling gave all schools equal chance to participate in the study.

According to Mugenda and Mugenda (2008), at least 10% of accessible population is enough for descriptive survey study. The five selected schools were G.S Nyamata catholique, G.S Ntarama, G.S Rango, G.S Rilima and G.S Twimpala. The 5 head teachers of school heads of selected schools was purposefully selected to yield 15 head teachers. In this study the sample therefore comprised of 282 respondents, means that 181 represented students who study in P5 and P6 from 5 schools, 88 TSLA teachers from different schools of Bugesera District, 5 head teachers, 3 Plan International employees (TSLA project Manager) and 5 sector education officers. In this study, a stratified random sampling was conducted to gather quality data. According to Taherdoost (2016), stratified random sampling is convenient where the population under study is composed of subgroups and is of heterogeneous characteristics.

The number of respondents was determined using the Yamane formula (1967).

$$n = \frac{N}{1 + \frac{Ne^2}{1 + 956 * 0.05^2}} \approx 282$$

N: stands for the target population/population size of the study
\(e\): is the level of precision equals to (5%)
n: Sample size

<table>
<thead>
<tr>
<th>Table 1: Targeted population and sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group of respondents</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Head teachers</td>
</tr>
<tr>
<td>Teachers</td>
</tr>
<tr>
<td>Students</td>
</tr>
<tr>
<td>SEO</td>
</tr>
<tr>
<td>Plan</td>
</tr>
<tr>
<td>International staff</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Source: Researcher, 2019

3.3. Data Collection and Analysis
The primary data was collected from hand in hand project by using close ended questionnaires. Closed ended questionnaires are those questions set that require the respondents to select from a list of responses. The questionnaires were distributed at the selected population like students, head teachers, Education Officers as well as Plan International Officials.

Interviews were also conducted with key informants who have information on impact of monitoring and evaluation on institution performance. These included head teachers, Plan International staff, and sector education officer among other project beneficiaries.

The data (views) from respondents categorized into themes upon which detailed explanation was based. For making sure that all the answers are logically and coherently recorded to facilitate understanding of phenomenon and cross check the data collect, the processes of editing and coding was considered. Once data edited and coded, they were statistically treated and analyzed using Statistical Package for Social Sciences (SPSS) to produce results.

4. RESEARCH FINDINGS AND DISCUSSIONS
4.1 Demographic Characteristics of Respondents
The section shows the background of the respondents according to their categories such as age, education level, family status, gender. The total number of the respondents was 282 and they were made of 5 head teachers, 88 teachers, 181 students, 5 sector education officers and 3 plan officers. Out of 269 questionnaires distributed to teachers and students, 181 were filled and returned giving a return rate of 67.3%. These were distributed across five different schools in five different sectors in Bugesera District.

<table>
<thead>
<tr>
<th>Table 2: Gender of the Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
</tbody>
</table>

Source: Field data, 2019
As shown in the Table 2 the respondents were given equal chance and the male were 133 of 282 equals 47.16% while female respondents were 149 of 282 equals to 52.84%. This means that the fair gender representation was ensured by the researcher during the study.

**4.1.3 Professional Qualification of the respondents**

The study sought to find out the academic qualifications of respondents among the teachers, head teachers, sector education officer and plan international officers in the division. The findings from the study are recorded in Table 3.

**Table 3: Academic Qualification of the respondents**

<table>
<thead>
<tr>
<th>Category</th>
<th>A Level</th>
<th>Diploma</th>
<th>Bachelors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>60</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>SEO</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Head teachers</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Plan Officers</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**Source: Field data, 2019**

The study established that majority of the respondents were qualified in education by their academic qualification. This means that they were quite qualified for handling issues related to the project monitoring and evaluation for institution performance.

**4.1.4 Teaching Experience**

The researcher was interested in finding out the experience of teachers handling implementation of competence based curriculum in the public secondary schools. The findings are indicated in Figure 2.

![Figure 2: Teaching experience for the teachers](image)

**Source: Researcher, 2019**

The study sought to find out the teachers handling implementation of competence based curriculum in the public secondary schools. The findings from the study are recorded in Table 3.

**Table 4: Descriptive Statistics from the respondents about how the project monitoring and evaluation affect the school academic performance**

<table>
<thead>
<tr>
<th>Statements</th>
<th>N</th>
<th>Mean</th>
<th>Stdev</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding of TSLA project monitoring and evaluation</td>
<td>181</td>
<td>4.503</td>
<td>1.063</td>
<td>1.129</td>
</tr>
<tr>
<td>Monitoring and evaluation make students and teachers to adhere to the teaching and learning rules and regulations efficient and effectively implemented</td>
<td>181</td>
<td>4.652</td>
<td>.703</td>
<td>.495</td>
</tr>
<tr>
<td>TSLA Project Monitoring and evaluation lead to effective academic performance in your school</td>
<td>181</td>
<td>4.459</td>
<td>.928</td>
<td>.861</td>
</tr>
</tbody>
</table>

**Source: Researcher, 2019**

Table 4 shows that majority strongly agreed with the given statements followed by those who agreed as it is shown by a mean greater than 4. However there was a significant difference between those who strongly agreed with the statement that teachers and students preparation of how the monitoring and evaluation facilitate the academic performance through project implementation especially those project related to the academic activities, due to the shown standard deviation.

**Table 5: Understanding of TSLA project monitoring and evaluation**

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>10</td>
<td>5.5</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>N</td>
<td>7</td>
<td>3.8</td>
</tr>
<tr>
<td>A</td>
<td>24</td>
<td>13.2</td>
</tr>
<tr>
<td>SA</td>
<td>135</td>
<td>74.7</td>
</tr>
<tr>
<td>Total</td>
<td>181</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Source: Researcher, 2019**

The respondents presented that they agreed that project monitoring and evaluation affect positively to the academic performance in the primary schools. Table 5 indicate the perception of the students on their understanding of TSLA Project monitoring and evaluation toward the institutional performance, the majority of the respondents (87.9%) indicated that they are agreed or strongly agreed that the projects are needed to their academic performance to be monitored and evaluated in their schools for the academic purpose as it is shown in Table 5.

**Table 6: Monitoring and evaluation make students and teachers to adhere to the teaching and learning rules and regulations efficient and effectively implemented**

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>1.6</td>
</tr>
</tbody>
</table>
they agreed with the statements given in Table 8, Table 9, Table 10 and Table 11.

**Table 8: Monitoring and evaluation aims at creating an overview of the quality of education in the school**

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>7</td>
<td>3.8</td>
</tr>
<tr>
<td>D</td>
<td>15</td>
<td>8.2</td>
</tr>
<tr>
<td>N</td>
<td>.1</td>
<td>.5</td>
</tr>
<tr>
<td>A</td>
<td>22</td>
<td>12.0</td>
</tr>
<tr>
<td>SA</td>
<td>131</td>
<td>74.3</td>
</tr>
<tr>
<td>Total</td>
<td>181</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Source: Researcher, 2019**

Table 8 shows that majority of the respondents indicated that project monitoring and evaluation aims at creating an overview of the quality of education in schools. It facilitates better the students to perform better in the academic activities with the given statements. This implies that monitoring and evaluation of the implementation of TSLA projects does influence academic performance of the learners significantly.

**Table 9: Descriptive Statistics of results from the respondents of second objectives**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>181</td>
<td>181</td>
<td>181</td>
<td>181</td>
</tr>
<tr>
<td>Mean</td>
<td>4.238</td>
<td>4.464</td>
<td>4.144</td>
<td>4.718</td>
</tr>
<tr>
<td>Std. Error of Mean</td>
<td>.099</td>
<td>.0824</td>
<td>.090</td>
<td>.061</td>
</tr>
<tr>
<td>Mode</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>1.327</td>
<td>1.108</td>
<td>1.211</td>
<td>.819</td>
</tr>
<tr>
<td>Variance</td>
<td>1.760</td>
<td>1.228</td>
<td>1.468</td>
<td>.670</td>
</tr>
<tr>
<td>Range</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
</tr>
</tbody>
</table>

**Source: Researcher, 2019**

Table 9 shows the descriptive statistics for the four different statements used to obtain responses from the respondents. As shown in the table all the means were above 4 showing majority were in agreement with the statements.

**Table 10: Monitoring and evaluation matches evidence against criteria, arrive at judgments and make those judgments known to stakeholders such as plan international**

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>14</td>
<td>7.7</td>
</tr>
<tr>
<td>D</td>
<td>9</td>
<td>4.9</td>
</tr>
</tbody>
</table>

**Source: Researcher, 2019**

Statement 1 Quality of teachers influence the project monitoring and evaluation toward the students’ academic performance
Statement 2 Monitoring and evaluation aims at creating an overview of the quality of education in the school
Statement 3 Monitoring and evaluation matches evidence against criteria, arrive at judgments and make those judgments known to stakeholders such as plan international
Statement 4 project monitoring and evaluation affect Professional development strengthens of students learning skills

Table 9 displays the descriptive statistics for the four different statements used to obtain responses from the respondents. As shown in the table all the means were above 4 showing majority were in agreement with the statements.

4.2.2 Monitoring and evaluation to improve school’s academic performance

The second objective for this study was to evaluate the level of monitoring and evaluation to improve school’s academic performance in Bugesera District. To achieve this objective the respondents were required first to indicate the extent to which...
The last objective for this study was to examine the challenges facing project monitoring and evaluation in Teacher Self Learning Academy project (TSLA). To achieve this objective the respondents were required first to indicate the extent to which they agreed with the statements given in Table 12, Table 13, Table 14 and Table 15.

Table 12: Descriptive Statistics of the results from respondents about the third objective

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>5</td>
<td>2.7</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td>N</td>
<td>3</td>
<td>1.6</td>
</tr>
<tr>
<td>A</td>
<td>16</td>
<td>8.7</td>
</tr>
<tr>
<td>SA</td>
<td>156</td>
<td>84.2</td>
</tr>
<tr>
<td>Total</td>
<td>181</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Researcher, 2019

Table 11 shows that majority (92.9%) strongly agreed (SA and A) with the statement that monitoring and evaluation matches evidence against criteria, arrive at judgments and make judgments known to stakeholders. This implied that M&E is important source of information for all stakeholders especially those not directly involved with the daily running of the project. The results displayed in Table 9 regarding this statement shoed that there were divergent views since the standard deviation was 1.212.

Table 12 shows that most of the respondents were in support of monitoring and evaluation to be implemented in their school since all the three statements had a mean score of more than 4. This implied that majority of the respondents were in support of the second objective of this research.

Table 13: The school management help the project monitoring and evaluation to be implemented in your school

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>18</td>
<td>9.9</td>
</tr>
<tr>
<td>D</td>
<td>12</td>
<td>6.6</td>
</tr>
<tr>
<td>N</td>
<td>11</td>
<td>6.1</td>
</tr>
<tr>
<td>A</td>
<td>26</td>
<td>14.4</td>
</tr>
<tr>
<td>SA</td>
<td>114</td>
<td>63.0</td>
</tr>
<tr>
<td>Total</td>
<td>181</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Researcher, 2019

Table 13 shows that majority of the respondents indicate that school management help in project monitoring and evaluation implementation in the schools. This revealed that even the management within the selected schools play a greater part in the implementation of project monitoring and evaluation. The findings in Table 12 shows that views were divergent among the respondents since the standard deviation was 1.357.

4.2.3 Challenges facing project monitoring and evaluation in Teacher Self in TSLA

The last objective for this study was to examine the challenges facing project monitoring and evaluation in Teacher Self Learning Academy project (TSLA). To achieve this objective the respondents were required first to indicate the extent to which they agreed with the statements given in Table 12, Table 13, Table 14 and Table 15.

Table 14: Project monitoring and evaluation helps me in teaching and learning process in my all subject

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>8</td>
<td>4.4</td>
</tr>
<tr>
<td>D</td>
<td>5</td>
<td>2.8</td>
</tr>
<tr>
<td>N</td>
<td>9</td>
<td>5.0</td>
</tr>
<tr>
<td>A</td>
<td>70</td>
<td>38.7</td>
</tr>
<tr>
<td>SA</td>
<td>89</td>
<td>49.2</td>
</tr>
</tbody>
</table>
The results displayed in Table 14 show that 97.9% of the respondents were in agreement (SA and A) that project M&E helps them in teaching and learning process. Only 4.4% of the respondents strongly disagree, 2.8% disagreed while 5% were neutral. The results showed that project M&E facilitates better the students to perform better in the academic activities with the given statements.

Table 15 shows that majority (95.5%) agreed (SA and A) with the given statements, 1.7% strongly disagreed (SD), 2.2% disagreed (D) and 0.6% neutral (N) to the statement. There was no significant difference between those who agreed with the statement that teachers and students preparation of the how the monitoring and evaluation facilitate the academic performance through project implementation. This because the standard deviation obtained for this stamen was 0.731 as shown Table 12.

### Table 15: The project monitoring and evaluation help students and teachers to be creative and innovative learner through the use of available resources

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SD</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>2.2</td>
</tr>
<tr>
<td>SA</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>D</td>
<td>20</td>
<td>11.0</td>
</tr>
<tr>
<td>N</td>
<td>153</td>
<td>84.5</td>
</tr>
<tr>
<td>Total</td>
<td>181</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Source: Researcher, 2019**

From the results from the discussion head teachers, teachers, plan international officer and SEO’s through the interview with them and the researcher, the majority of the respondents indicated that monitoring and evaluation affect positively the students’ academic performance and especially the teachers showed their side by encouraging different project to be implemented in education because they were agreed that TSLA made the significance roles in academic activities the schools.

### 4.2.4 The correlation between monitoring and evaluation and institutional performance

The respondents were asked to give their views on the correlation between project monitoring and evaluation and institutional performance in TSLA Project.

### Table 16: Correlations of variables

<table>
<thead>
<tr>
<th></th>
<th>project monitoring and evaluation</th>
<th>institutional performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>project monitoring</td>
<td>Pearson Correlation</td>
<td></td>
</tr>
<tr>
<td>and evaluation</td>
<td>Sig. (2-tailed)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>institutional performance</td>
<td>Pearson Correlation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>.715**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>181</td>
<td>181</td>
</tr>
</tbody>
</table>

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

**Source: Researcher, 2019**

The findings in Table 16 show that project monitoring and evaluation and institutional performance were correlated with the success of TSLA project. The correlation coefficients r=0.715 was produced with p-value of 0.000 of a 2-tailed. The findings show strong positive and statistically significant correlation between the two variables. Therefore project monitoring and evaluation significantly improves institutional performance especially the primary schools in Busesera District.

5. CONCLUSION AND RECOMMENDATIONS

Based on the findings for this study, the researcher concluded that the project monitoring and evaluation greatly influenced academic performance in schools and that the TSLA project implementation process needs monitored and evaluated to enhance more efficiency. This is because most of the respondents (81.7%) indicate that the teachers and students needs more resources for academic activities and TSLA should help them for their performance, lesson plan preparation, use of ICT and schemes of work, which are implementation practices of TSLA activities, increases academic performance in English.

Secondly, the school management significantly influenced the performance of English and that the management needs to be audited to suit the needs of TSLA projects. Thirdly, the study concluded that the teachers’ professional development determines academic performance in English since this is one of requirements of the implementation of TSLA projects in schools. This is evident since there is a strong positive correlation (r = 0.715) between project monitoring and evaluation and academic performance of the schools. Finally, the study concluded that there is a strong positive relationship (r=0.715) between instructional policy and planning and academic performance in English. It was established that majority of the responses (62.1%) strongly agreed that project monitoring and evaluation
of instructional policy and planning significantly influenced academic performance of English.

5.4 Recommendations of the Study

From the research findings the researcher made the following recommendations:

i) Project Monitoring and evaluation help the institution to perform better especially primary and secondary schools so TSLA projects coordinators and plan international should influence more the TSLA activities in the schools to enhance students the academic performance in Bugesera District

ii) School management and SEO may audit every day means to make follow up TSLA’s activities to raise students academic performance

iii) Teacher and students to be monitored and evaluated to ensure that they benefit from the TSLA’s activities for their teaching and learning process

iv) The ministry of education to hire and train more quality assurance and standards officers to conduct project monitoring and evaluation to enhance the quality of education with the help of NGOs in schools to ensure educational projects and programs are implemented to promote good academic performance of the learners.

REFERENCE


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Ecological responsibility of tourism

Abdulwahab Tenish
Phd, Candidate

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Abstract- As it becomes obvious that ecotourism is a growing market, governments around the world are showing a rising interest in drawing attention to ecotourism as part of their tourism development program. Ecotourism implies conscientious travel in nature while preserving the environment and improving the living standards of the local population and is one of the most dynamic segments of the international travel industry.

Index Terms- Ecotourism, Preservation and protection, sustainable development

I. INTRODUCTION

Today's increased interest in sustainable tourism and ecotourism is the result, among other things, of increasing public awareness of the quality of protected areas and the impacts of tourism. The main role of the ecologically protected area as a tourist destination (which is today one of the most common ecotourism destinations) is to ensure the quality of guests and the long-term existence of the local population.

Ecology has become equally a trend and an essential need of modern society. Return to pure untouched nature, organic food, use of natural materials, renewable energy sources, etc. is a world movement that is reflected in tourism as an integral part of society. There is almost no country in the world that does not have at least one national park, and there is also almost no country that, to a greater or lesser extent, does not improve the development of tourism.

Preservation and protection of these areas requires large investments, which governments cannot fully service from budget funds, so the management of these areas provides the necessary financial resources through the implementation of commercial activities such as tourism. Numerous researches show that the highest growth rate from year to year is recorded by the types of tourism related to staying in pure untouched nature, with engaging in some kind of recreation or extreme sports. New exotic destinations are being sought to be discovered and explored. All this indicates that the quality and attractiveness of the natural environment form the basis of the economy in tourism.

II. NOVELTIES IN THE GLOBAL TOURISM MARKET

Tourism has begun to transform from a "hard" to a "soft" form, becoming more humane and more individual-oriented. On this track, different types of tourism are emphasized, e.g. urban, cultural, rural, nautical, congress, religious, ecotourism, adventure, etc. To create a layered and transparent tourist offer as required by modern tourism, just one striking tourist attraction is no longer enough, such as a warm sea or an impressive mountain, which in "mass" tourism is marked as the primary tourist area. Studying the professional literature, we find that many authors have different views on the importance of certain tourist megatrends for the development of this industry in the future.

Megatrends in tourism are, among others: Timesharing (capacity lease), Incentive Travel, Fast food business, Theme Parks.

The World Tourism Organization - WTO, highlights five megatrends in tourism²: ecotourism, cultural tourism, thematic tourism, cruises.

Common to all classifications is that as motives for tourist travel in the foreground emphasize fun, excitement and gaining new experiences in the natural environment. New exotic destinations are being sought to be discovered and explored. As a rule, the population that prefers these types of tourism is richer, has a higher education, great readiness to undertake travel and is a better consumer than the average tourist, so we can talk about elite tourism because of all that. Such tourist trends largely correspond to protected areas. Knowing these trends, the management of protected areas has the opportunity to put care and efforts to protect nature in the foreground of communication with visitors. It should be emphasized that every visitor and money that spends a new step towards long-term and sustainable development of the area.³ Accordingly, such regions should use their industrial underdevelopment to attract tourists to their area who want to visit untouched natural areas. However, the arrival of such tourists in these destinations requires at least minimal infrastructure, which many regions still do not have.

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Footnotes:
1 Bakić, O., (1993). Marketing menadžment turističke destinacije, Ekonomski fakultet, Beograd
3 Vujović S., Cvijanović D., Štetić S., (2012), Destinacijski concept razvoja turizma, Monografija, Institut za ekonomiku poljoprivrede, Beograd

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For many destinations, tourists spend on accommodation, food and drink, local traffic, entertainment, shopping, etc. are an important pillar of their economies. As the economic gap between developed and underdeveloped regions deepens, tourism seeks a way out of the vicious circle of underdevelopment and poverty. Many developing countries have turned to tourism as a way of acquiring the financial resources necessary for economic growth, employment and development. Tourism in these countries has emerged as a relatively new activity that has achieved significant results in a short time.

III. ECOTOURISM AS A MEANS OF PROTECTING NATURAL RESOURCES

In response to the forms and phenomena of mass tourism, which lead to pollution, endangerment of natural values, exceeding the reception capacities of tourist destinations, at the end of the XX century, selective forms of tourism appeared as an alternative to mass tourism. One of the most important forms of selective tourism is certainly ecotourism.

Monitoring of the interplay between the development of large tourist centers and protected areas, coastal belts and green areas must be done continuously in order to contribute to finding a way to establish a harmonious and functional environment in which local people will have favorable living and working conditions while tourists can continue to consumption, which is the ultimate goal of the travel industry. From a socio-economic, environmental and planning point of view, care for the environment is justifiably growing today, so an integral part of urban policies for more than twenty years is the concept of sustainable development. they are not always fully accepted.4

Ecotourism has become a potential alternative to destructive industries in Latin America, such as logging, oil drilling, mining, and other industries that extract natural resources.5 People are starting to look for more adventure and eco-friendly ways to travel. In addition, developing countries have begun to see the disadvantages and negative consequences of traditional tourism as a development strategy. The situation in Africa is somewhat different from the situation in Latin America.

Ecotourism in East Africa has become popular as an alternative to the failed system of protective wildlife management, which has been reduced to separating the local population from national parks. This approach emerged as a reaction to the poaching of elephants and rhinos. Scientists and officials of national parks believed that the only way to protect these, as well as other, wild animals, is to provide a financial stimulus to parks, preservation of wildlife and tourism.6

If we compare the features of eco-tourism and the principles of environmental protection, it becomes clear that ecotourism is fully in line with the concept and goals of achieving high quality environment. Ecotourism has also proven to be one of the best mechanisms for providing financial resources for the maintenance of protected areas. This has been shown primarily in less developed countries where the main resources are precisely in the field of biodiversity and where their biological and cultural diversity represents ecotourism potential.

It is clear that ecotourism in these countries is considered not only as an activity dedicated to financing environmental protection, but also as a way to improve the country’s economy by attracting more tourists. The goal of ecotourism in such business ventures is not to destroy natural resources but to provide support for their protection. Ecotourism offers a sustainable alternative to making money and at the same time works to preserve irreplaceable natural resources. Ecotourism seems to continue to flourish around the world, and foreign tourists will still want to travel to countries that care about the environment. Valuable national treasures are often sacrificed under the slogan of ecotourism, due to greed and the desire for quick earnings, without taking into account the needs of the generations to come. To avoid this, it is necessary to apply international standards in this area. It is often believed that in underdeveloped areas, with small investments, ecotourism can develop quickly and provide large incomes and well-being. However, not every underdeveloped area may always be an ecologically interesting area. Also, an undeveloped area is not always a clean and unpolluted area. Any undeveloped area without built infrastructure and built legislation and its firm application is not an area for ecotourism, because mass visits of guests are not ecotourism. Environmentally sensitive consumers are increasingly aware of the harmful effects that tourism has on the area and are increasingly interested in travel that will have minimal adverse effects on the natural environment. Care for the preservation of air, water, flora and fauna, space, etc. today it is more and more present among tourist representatives and tourists themselves. Ecotourism is a specific form of tourism in which ecologically conscious individuals and groups participate, who by their actions on the environment try to reduce the effects created by the so-called. mass tourism. Unlike types of tourism that are only focused on destinations in nature, which are essentially a simple trip to areas with beautiful nature, ecotourism benefits the local population in environmental, cultural and economic terms.

IV. ECOTOURISM SUSTAINABILITY CRITERIA

The criteria necessary for the development of ecotourism according to Ross and Wall (1999) are7:

1. Preservation of biodiversity and cultural diversity, by achieving a minimal impact on the natural resources of protected areas.
2. Generating sustainable and legal income for the benefit of local communities.
3. Involvement of local communities, ecotourists, tour operators and government institutions in planning and development processes.
4. Increasing environmental and cultural knowledge through respect for local traditions and culture.

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4 Čekrlija Saša, (2017), Ekoturizam i održivo upravljanje resursima, SVAROG br. 14., DOI 10.7251/SVA1714227C
5. Generation of revenues intended for the preservation of protected areas.
6. Teaching shareholders about their role in the nature conservation process.

In the field of sustainable development, everyone must cooperate, both state and local authorities, as well as entrepreneurs, private individuals, local residents and visitors. It is necessary to edit and monitor the system of indicators. All participants in sustainable tourism development must be permanently educated. The consequences of the activities of individual companies must be visible to visitors, because otherwise the interest of companies in investing in the field of environmental protection cannot be seen. It is also necessary to enable information about that to reach the visitors. The visitor will look for ecological, ie the best products for the environment in the tourist destination, which will bring economic, ecological and socio-cultural benefits to the tourist workers in the tourist destination.\(^8\) Sustainable development indicators measure changes in all these areas together, ie the effects of changes in one area, which are also recorded in the remaining areas. Sustainable development indicators can therefore be used in different tourist destinations or countries for different purposes. The indicators reflect the changes that are the result of cause-and-effect relationships in the environment.

V. CONCLUSION

Ecotourism implies conscientious travel in nature while preserving the environment and improving the living standards of the local population and is one of the most dynamic segments of the international travel industry. The basic principles of ecotourism are minimizing the negative impacts on nature and culture that can harm the destination, educating travelers about the importance of protection, direct income from protection and management of natural and protected areas. Research shows that the highest growth rate from year to year is recorded by the types of tourism associated with staying in pure untouched nature, with engaging in some form of recreation or extreme sports. New exotic destinations are being sought to be discovered and explored. Successful implementation of environmental components (environmental protection, giving preference to those products that are organized in accordance with environmental standards, etc.) in the future implementation of marketing activities in tourism is the basis on which to permanently build competitiveness in tourism. The development of tourism should emphasize the ecological, health, recreational values and specifics of the receptive space. Eco destinations attract modern tourists, giving them a sense of closeness to natural values and the local community, while protecting their resources. Ecotourism is an environmentally friendly journey, which emphasizes the observation and preservation of natural habitats and archaeological treasures, a means of environmental protection, environmentally responsible tourism, a way to protect natural areas that includes economic gain, through the protection of natural resources.

REFERENCES


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Study of Ear-Face Index Among the Youth of Madhesis Community of Nepal

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10747

Abstract- INTRODUCTION: Ear is an important complex of the facial complex, which gives an impression of the bearer’s age and sex. From aesthetic point of view the shape, size and spatial location of the ears are very important. Any abnormality is an indication of anomaly in the subject. The biometrics of ear is a very interesting issue as during crime scene investigation, ear marks and measurements are often used for identification in the absence of valid fingerprints. Ear biometrics can positively identify an individual using comparative analysis of the human ear and its morphology.

MATERIALS AND METHODS: This study was carried out among residents of Rammagar Gaupalika-7, Sarlahi, Nepal, one of the core region of Madhesh Nepal dated Jan 2020 to March 2020. The cohort consists of independent adults of age group 17-35 and consenting adults from the metropolis. Ethical approval was sought and obtained from the supervising ethical committee of the Nobel Medical College Teaching Hospital, Biratnagar, Nepal. Consent for the recruitment of the subjects were taken from the subjects by taking written consent. Subjects were randomly selected and those that had scars on the ears other than the usual ear piercing for rings and those with observable defect or growths were excluded from the study. No interventions or investigations were done. Only digital photography were taken. This caused no harm to the subjects. The photographs were used for research purpose only. Sample size: 50 male and 50 female.

RESULTS: Mean facial height of 193.92 (19.66) mm. for males was significantly longer than the facial height of women 169.68 (17.21) mm. The ear face indices were 33.86 (3.18) % and 33.08 (3.05)% in males, right and left respectively and 36.76 (3.55)% and 35.40 (3.44)% in females. The mean ear heights were 65.25 (5.88) mm for right ear and 63.80 (5.95) mm for left ear for the male individuals. Whereas for female the mean ear height for right side was 62.06 (3.79) mm and 59.69 (3.86) mm for left ear. There were significance differences between both the ear height in both the genders male and female.

DISCUSSION: Significant variations exist between the male and the female sexes in height of ear as well as the facial height and ear-face index. Several studies have indicated that male facial height was higher than female’s. This study has also confirmed that the length of face in case of male individual is significantly larger than that of the female. The ear-face index also concludes that the larger index in case of female as compare to the male might be because of the aesthetic purpose.

CONCLUSION: Significant variations do exist among ethnic groups and, and sexual dimorphism also do exist. The data obtained in our study may be useful as a reference for facial analyses that will be further useful in anthropological research, forensics, genetic research, medical clinical practice (reconstructive surgery) and in cosmetology. This study will serve as a basis of comparison for future studies in other ethnic group of Nepali population.

Index Terms- Anatomy, Anthropometry, External Ear, E-F Index, Gender Variation

I. INTRODUCTION

Ear is an important complex of the facial complex, which gives an impression of the bearer’s age and sex. From aesthetic point of view the shape, size and spatial location of the ears are very important. Any abnormality is an indication of anomaly in the subject. The shape and size of ear is influenced by the age, sex and ethnic origin. Abnormalities of the ear such as missing external ear, prominent ears, lobule ptosis and microtia may result from trauma, surgical resection, tumours, or congenital deformities. For the psychological stability of the subjects also the surgical correction of the anomalies are required. The biometrics of ear is a very interesting issue as during crime scene investigation, ear marks and measurements are often used for identification in the absence of valid fingerprints. Ear biometrics can positively identify an individual using comparative analysis of the human ear and its morphology. The dimensions of the pinna have been found to vary among different ethnic groups. The external ear consists of the auricle or pinna, and the external acoustic meatus. The auricle projects to a variable and individual degree from the side of the head and collects sound waves, which it conducts along the external acoustic meatus to the eardrum, the tympanic membrane. The external ear is composed of three primary components; the helix-antihelical complex, the conchial complex, and the lobe. The visible part is called the auricle, also known as the pinna, especially in other animals. It is composed of a thin plate of yellow elastic cartilage, covered with integument, and connected to the surrounding parts by ligaments and muscles; and to the commencement of the ear canal by fibrous tissue. Many mammals can move the pinna (with the auricularis muscles) in order to focus their hearing in a certain direction in much the
same way that they can turn their eyes. Most humans do not have this ability. One consequence of the configuration of the outer ear is selectively to boost the sound pressure 30- to 100-fold for frequencies around 3 kHz. This amplification makes humans most sensitive to frequencies in this range — and also explains why they are particularly prone to acoustical injury and hearing loss near this frequency. Most human speech sounds are also distributed in the bandwidth around 3 kHz.

The face is the anterior part of an human's head that bear three of the head's sense organs, the eyes, nose, and mouth, and through which animals express many of their emotions. The face is crucial for human identity and damage such as scarring or developmental deformities affects the psyche adversely. The face is the feature which best distinguishes a person. Specialized regions of the human brain such as the fusiform face area (FFA), enable facial recognition; when these are damaged, it may be impossible to recognize faces even of intimate family members. The pattern of specific organs, such as the eyes, or of parts of them, is used in biometric identification to uniquely identify individuals. The shape of the face is influenced by the bone-structure of the skull and each face is unique through the anatomical variation present in the bones of the viscerocranium (and neurocranium). The bones involved in shaping the face are mainly the maxilla, mandible, nasal bone and zygomatic bone. Also important are various soft tissues, such as fat, hair and skin. Facial shape is an important determinant of beauty, particularly facial symmetry.

 Craniofacial anthropometry, as an important part of anthropology and medicine, is used for the determination of the morphological characteristics of the head and face. Face shape depends on many factors, such as gender, race and ethnicity, climate, socio-economic, nutritional, and genetic factors. The determination of facial parameters is of great importance for the evaluation of facial trauma, congenitaland traumatic deformities and easier identification of certain congenital malformations. The collected data can be used in anthropology and forensic medicine for identification of racial and sexual differences as well as in reconstructive surgery for facial reconstruction.

Facial height is the distance between trichion to gnasion. Trichion (tr) is the point on the hairline in the midline of the forehead, gnathion (gn) is the lowest median landmark on the lower border of the mandible.

Anthropologists use it for people of Indian ancestry residing in Terai of Nepal and comprising various cultural groups such as Hindu caste groups, muslims , merchants and indigenous people of the Terai. Madheshi people comprise caste groups like Brahmin, Teli, Suri, Yadav, Gupta, Kayastha, Bhumihar and Dalit as well as ethnic groups such as Maithils, Bhojpuri, Awadh, and Bajikina speaking people. Indian immigrants settled foremost in present-day eastern Nepal Terai since the late 18th century, when the rulers of Nepal encouraged deforestation and agricultural development of this region.

II. MATERIALS AND METHODS:

This study was carried out among residents of Ramnagar Gaupalika-7, Sarlahi, Nepal, one of the core region of Madhesh Nepal dated Jan2020 to March 2020. The cohort consists of independent adults of age group 17-35 and consenting adults from the metropolis. Ethical approval was sought and obtained from the supervising ethical committee of the Nobel Medical College Teaching Hospital, Biratnagar, Nepal. Consent for the recruitment of the subjects were taken from the subjects by taking written consent. Subjects were randomly selected and those that had scars on the ears other than the usual ear piercing for rings and those with observable defect or growths were excluded from the study. No interventions or investigations were done. Only digital photography were taken. This caused no harm to the subjects. The photographs were used for research purpose only.

Sample size: 50 male and 50 female.

III. PROTOCOL OF THE PROCEDURE:

- For the purpose of this study, unique digital signal processing technology, the megapixel camera was used to enable high-resolution system.
- The subjects were made to sit comfortably on a chair in such a way that the subject looking straight forward keeping the face in Frankfurt’s line, i.e., the inferior border of orbit and center of external acoustic meatus lies in the same horizontal line with a white ruler placed behind the pinna exactly parallel to the auricle.
- Lateral surface of the auricle was photographed in such a way that mid-vertical grid line of the camera aligned to pass through the mid-sagittal plane of the face while the mid-horizontal pass through the Frankfurt’s plane.
- Digital images were transferred to a computer and the images were analyzed with Adobe Photoshop software (version 7.0, Adobe systems, San Jose, California). First of all, various soft tissues landmarks were tagged on the subject’s ear photograph and then different parameters were measured by Image J 1.48 software Image J (v 1.48 Jawa1.6.0_20 64bits).

The following anthropometric parameters were measured by indirect method and variation according to age and sex:

1. Ear height: supra-aurale to sub-aurale.
2. Facial height: trichion to gnasion.
3. Ear-face index = ear height/ face height x 100.

Statistical Analysis:

The results were calculated as mean±standard deviation. The Pearson correlation will be used to institute the association between age, sex, and external ear anthropometry. The data were analyzed using BM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp., and p<0.05 considered as level of significance.

IV. RESULTS:

In present study, 100 individuals were selected with age of 18 to 35years were selected and consisting of 50 males and 50 females individual. According to the obtained data the following parameters were recorded.

Facial Parameters
The facial height for male ranged from 148 mm to 237 mm. The mean was 193.92 (19.66) mm for male individual. The facial height for female ranged from 138 mm to 193 mm. The mean was 169.68 (17.21) mm for female individuals.

Mean facial height of 193.92 (19.66) mm for males was significantly longer than the facial height of women 169.68 (17.21) mm. The ear face indices were 33.86 (3.18)% and 33.08 (3.05)% in males, right and left respectively and 36.76 (3.55)% and 35.40 (3.44)% in females.

### Table:1 - Descriptive Statistics for measurements of male for right ear

<table>
<thead>
<tr>
<th>Sample size (N)</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
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</thead>
<tbody>
<tr>
<td>R. EAR HEIGHT</td>
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<td>50</td>
<td>76</td>
<td>65.25</td>
</tr>
<tr>
<td>FACIAL HEIGHT</td>
<td>50</td>
<td>148</td>
<td>237</td>
<td>193.92</td>
</tr>
<tr>
<td>E-F INDEX</td>
<td>50</td>
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<td>42</td>
<td>33.86</td>
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<tr>
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</tbody>
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### Table:2- Descriptive Statistics for measurements of Male for left ear

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<th>Minimum</th>
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<th>Mean</th>
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<td>L.EAR HEIGHT</td>
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<td>48</td>
<td>75</td>
<td>63.80</td>
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<tr>
<td>FACIAL HEIGHT</td>
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<td>148</td>
<td>237</td>
<td>193.92</td>
</tr>
<tr>
<td>E-F INDEX</td>
<td>50</td>
<td>27</td>
<td>41</td>
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</tr>
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</tbody>
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### Table:3-Descriptive Statistics for measurements of Female on right ear

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</thead>
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<tr>
<td>R. EAR HEIGHT</td>
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<td>56</td>
<td>70</td>
<td>62.06</td>
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<tr>
<td>FACIAL HEIGHT</td>
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<td>193</td>
<td>169.68</td>
</tr>
<tr>
<td>E-F INDEX</td>
<td>50</td>
<td>32</td>
<td>46</td>
<td>36.76</td>
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### Table:4-Descriptive Statistics for measurements of Female on left ear

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<th>Std. Deviation</th>
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<tr>
<td>L.EAR HEIGHT</td>
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<td>52</td>
<td>68</td>
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<tr>
<td>FACIAL HEIGHT</td>
<td>50</td>
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<td>193</td>
<td>169.68</td>
</tr>
<tr>
<td>E-F INDEX</td>
<td>50</td>
<td>31</td>
<td>44</td>
<td>35.40</td>
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<td>Valid N (listwise)</td>
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</table>

### Ear Parameters

**Ear Height:** The mean ear heights were 65.25 (5.88) mm for right ear and 63.80 (5.95) mm for left ear for the male individuals. Whereas for female the mean ear height for right side was 62.06 (3.79) mm and 59.69 (3.86) mm for left ear. There were significance differences between both the ear height in both the genders male and female. The mean height of male ear were greater than that of the female individuals.

V. DISCUSSION

The mean ear height for both right and left ears in this study was similar to the study done by Sullivan et al, where the mean height of ear was 63 mm. There was statistically significant asymmetry between the height of ear on right and left side which is similar to the findings of Sforza et al. The left ear height was smaller than that of the right side throughout the cohort study. The possible reason behind this asymmetry may be the genetic and the ethnic factor.

Significant variations exist between the male and the female sexes in height of ear as well as the facial height and ear-face index. Several studies have indicated that male facial height was higher than female’s. This study has also confirmed that the length of face in case of male individual is significantly larger than that of the female. The ear- face index also concludes that the larger index in case of female as compare to the male might be because of the aesthetic purpose.

The mean facial height observed in our study (193.92 mm ±19.66) for male was higher than the value obtained in a survey conducted among residents of Benin city Nigeria (183.0 ±21.6 mm), for female (169.68±17.21 mm) lower than (176.9±19.5),
where all the age groups were considered in the study. The mean E-F index for male and female was higher than that of their study. The data obtained in the present study may be useful in anthropological research, forensics, genetic research, as well as in medical clinical practice (reconstructive surgery). As particularly the youth of Madhesis community were considered.

There were distinct variations in ear proportions among the ethnic groups studied is unlikely to be noticeable at conversational distance. However, it demonstrates recognizable ethnic characteristics with both anthropological and forensic implications. The variation is likely to be genetic. Such variations have been described in multi-ethnic populations and their characteristics have been applied in reconstruction and rejuvenation procedures. So among the Madhesis community on the basis of morphology of face and ear it can be easily identified that the individual belongs to the community on the basis of above data.

VI. CONCLUSION:

From our present study, we conclude that the mean total height of ear and total height of face in case of male was higher than that of the female in Madhesis community. The mean E-F index is however in male is lower than that of the female individuals. Significant variations do exist among ethnic groups and, and sexual dimorphism also do exist. The data obtained in our study may be useful as a reference for facial analyses that will be further useful in anthropological research, forensics, genetic research, medical clinical practice (reconstructive surgery) and in cosmetology. This study will serve as a basis of comparison for future studies in other ethnic group of Nepali population.

ACKNOWLEDGEMENT:

First of all I would like to thank the rural ward director of Ramnagar-7 Gaupalika, Sarlahi, Nepal for giving me the opportunity to carry out the study. And special thanks go to my brother Radhe Shyam Sah and the respondents for co-operating in data collection. At last I would like to thank my HOD and Nobel Medical College for allowing me to go for data collection.

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Learning Comics for Students in Citizenship Education Courses

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Abstract- Comics which were compiled as teaching material for Introductory Education courses were arranged because there was not any learning media has been used. Thus, the teaching and learning process feels monotonous and less interesting. The development of comics in the civic education course used research and development method from Borg and Gall. Testing was carried out on three experts, namely material, language and media experts, then a small-scale group test (20 students) and a large-scale group test was carried out on 60 students in Semester II. Data collection techniques used questionnaires, interviews, tests and documents. The results of the small-scale group test obtained a mean response of 86.3% and involved in very attractive criteria. The results on the large-scale group test obtained an average score of 88.7% which is also involved very interesting criteria. Based on the validation that has been carried out on experts, the mean score of the assessment is 86.9% which means it is very interesting and it is concluded that comic is suitable to be used in civic education course.

Index Terms- Comic, Civic Education

I. INTRODUCTION

The development of science and technology is currently very rapid and has changed most aspects of people's lives. Almost all aspects of life have become practical since the rapid development of science and technology, and make people enjoy and prefer everything that is instantaneous. Likewise, it happens in the educational aspect. If technology is used positively, it has a very big and good impact on the development of education. The development of technology makes education more modern and raises many ideas that basically have the same purpose to facilitate understanding of education and improve human resources in the future. Technology is very useful in the development of learning, because it can be a very powerful tool or medium for transforming learning material. In line with the very rapid development of information technology, it is starting to require teachers to be able to continuously update their knowledge and skills in creating creative and innovative learning media in every learning process. Therefore, in the world of education, it must adapt toward times period in order to be able to provide quality output as needed. Education is required to provide human resources who have high intellectuality, skills, and good character.

When we discuss education, it cannot be separated from learning activities. According to Yunita, (2017: 1) learning is a process of interaction or communication between learners, teachers, and teaching materials. (Suardi, 2018: 6) explains that learning is an effort that deliberately involves and uses professional knowledge possessed by an educator to achieve curriculum goals. Learning is a process of interaction between students and learning resources. Learning is an assistance provided by an educator to students so that there is a process of acquiring knowledge, mastery, proficiency, and the formation of attitudes and beliefs in students. So learning is a process in helping students learn well. The learning process can be experienced by human anywhere and anytime.

Every time you carry out the learning process, it is always desired to achieve predetermined goals. In order to achieve the desired learning objectives, good learning activities are needed. Good learning outcomes are obtained from several factors. One of these factors is through the learning media used by an educator in the classroom. (Sumiharsono and Hasanah, 2017: 10) suggest that in general, the media has used including:
There are many things occur in the learning process. However, teachers only focus on delivering material to students without any media that can attract students' attention. It will make students have difficulty in achieving the learning objectives. Meanwhile, the use of relevant learning media in the classroom can help teachers deliver the material they want to convey. However, teachers should know the problems of students in the classroom before conveying the material. It aims to find out suitable learning media which will be used in the classroom. In using interesting teaching media, it will help students understanding the material being studied and make the learning process more enjoyable. The diversity of the media used in learning is really needed by teachers because interesting learning media will make students more enthusiastic in the learning process.

The teachers' task in delivering the material being taught is not only presented verbally, but also in a visual way. Learning sources which are usually used by teachers in the classroom are textbooks. However, relying solely on textbooks is not enough. Therefore, they need to develop teaching media that are innovative, effective and efficient. One of the media which can help teachers in learning activities is by using comic. (Darmawan in Hidayah, 2017: 37) explains that "a comic is a cartoon that describes a character who plays a story in a tight order, is connected to an image and is designed to provide entertainment to the readers". In addition, comic is a form of pictorial news, consisting of various situation stories that are continuous and sometimes humorous. From comic, it has purpose to be a source of learning and motivating students improving the results of learning. This time, the researchers chose to develop teaching media in the form of comics in the civic education course to be applied to students. The teaching media in the civic education course is presented in the form of comics expected to help students understanding the material easily. Therefore, the researchers want to conduct a research entitled "Learning Comics for Students in Civic Education Course". Based on the 'background' which has been explained, it can be concluded that the formulation of the problem in this study is: What is the level of effectiveness of comic as teaching media for students in civic education course? While the aim of researchers in conducting this research is to produce effective teaching media for students in civic education course.

II. Research Method

Research is a systematic activity in finding answers to an existing problem by collecting data for specific purposes. The development of comics in the civic education course used research and development method from Borg and Gall. In this research and development, the researchers simplified the development into seven steps into the final product and applied in educational institutions. Here, the seven development steps according to Borg and Gall (Slamet Riyanto and Aglis Andhita Hatmawan, 2020: 5-7):
Gambar 2. Research Stage

The subject of the test was carried out on three experts, namely material, language and media experts, then small-scale (20 students) and large-scale group tests were carried out on 60 students of second semester-the academic year 2019. While the data collection techniques used questionnaires, interviews, tests and documents.

III. FINDINGS AND DISCUSSION

The researchers started the product creation in several stages, namely: 1) Plot design was carried out to determine the characters and storylines; 2) Creating and compiling scenarios using Microsoft word; 3) Comic design made and processed using Corel Draw. The format in this comic learning media consists of a cover page, character introduction, usage descriptions, learning materials formed in a comic, and question exercises. Below is an example of a comic image.
Figure 3. Comic 1

Kucing adalah makhluk hidup yang bertahan hidup dengan mengandalkan nalurinya, sehingga tidak bisa membedakan atau bahkan mempedulikan dampak dari sesuatu yang dimakan. Sedangkan, manusia pada hakikatnya adalah makhluk hidup yang dapat berpikir dan mempunyai hasrat ingin tahu yang tinggi. sehingga, manusia dapat membedakan mana yang baik dan yang buruk. Kemampuan berpikir manusiapun dapat berkembang melalui pelatihan atau pendidikan.
Oh, ternyata itu penyebabnya. Lalu, mengapa hewan tidak bersekolah saja agar kemampuan nalurinya dapat meningkat?

Loh... kok ketawa? Nalurikan bisa diasa dengan pendidikan seperti yang kamu jelaskan.

Hahahaha... abis pertanyaanmu aneh banget. Emang sih, naluri itu bisa diasa. Namun, bukan melalui pendidikan khususnya di sekolah. Soalnya, naluri merupakan sifat alami yang dimiliki makhluk hidup selain itu hewan tidak mempunyai akal sehingga tidak dapat berpikir.

Oh... itu

Figure 4. Comic 2
Before comic products are tested in the field, the products are first validated by material experts, language experts and media experts. Validation by experts is done, in order to make this comic can be developed and it is appropriate to be tested on students. In addition, experts’ validation also can solve errors and deficiencies in the material. Thus, it does not experience many errors in accordance with what is needed by students. Based on the calculation of the assessment of each material expert validation in stage I, the observations made got a score of 78.6% and 75%. These results have shown that comic is already in the feasible category to be used, but it still requires revision. After the second stage validation of the material expert, the score was obtained a mean of 100%. For the validation...
of stage I language experts scores were 75% and 78.6%. These results have shown that the comic is already in the feasible category to be used, but it still requires revision so that further validation is carried out in stage II which gets a score of 96% and 100%. While in the stage I media expert validation obtained the score of comic was 78%. These results have shown that the comic is already in the feasible category to be used but it still requires revision so that it is validated at stage II which gets a score of 100%. If matched with the eligibility criteria, then all scores of achievement obtained are included in the valid criteria.

1. The Result of Comic Attraction Level Test.
   The level of attractiveness of the comic got a very good response from students. It was shown from the results of the response of questionnaire given to students and it showed that comic is very interesting. The results obtained from trials on students in small groups got a mean score of 87%. While trials in large groups got a mean score of 88%. As for the statement given by one of the students regarding the existence of comic as teaching media, namely: “The existence of comic in the civic education course makes learning more enjoyable. It is because there is a story line and pictures that make the learning process less boring. The existence of this comic also makes the learning process easier to be understood”.

2. Efficiency Test Results for Comic.
   Learning by using comic can make students easier to understand the material. In addition, learning using comic can also be a good way to learn independently. Comic is more attractive for students because the contents are not only written, but also they are presented in the form of pictures.

3. Result of Comic Effectiveness Test.
   In this small group test, the mean calculation of students' daily test results before using comic obtained a mean score of 76.8. Meanwhile, the score obtained after using comic learning media is 84.7. It can be concluded that in the small group test the mean score obtained by students after using comic is greater than before using comic. In the large group test, the mean calculation of the results of students' daily tests before using comic obtained a mean score of 75.75. While the score obtained after using comic is 84.33. It can be concluded that in the large group test the mean score obtained by students after using comic was greater than before using comic.

Comic can be said to be effective to be used in the learning process. It is shown by the results of trials with students on a small scale and trials on a large scale. This statement is supported by (Daryanto, in Fitra Yurisma Kanti, Bambang Suyadi and Wiwin Hartanto, 2018: 140) stating that teaching media can be said to be effective if it can increase the achievement of learning objectives. The level of achievement of these goals is in the form of increased knowledge, skills, and development of attitudes through learning process. So, it can be concluded that comic is very effective if it is used for learning civic education course.

IV. CONCLUSION

Based on the research and development that has been done, it can be concluded that the Comic Teaching Media Development for civic education course refers to the development stage according to Borg and Gall which is grouped into seven stages. In research and development, an assessment of comic teaching media has been carried out by material experts, language experts and media experts. The score obtained for the comic instructional media in the civics education course falls into the very feasible category. Meanwhile, for students, it is conducted trials on a small scale and trials on a large scale. The scores obtained were also very different before and after using comic in teaching and learning process. It shows that comic can help students in learning and help students to understand easily the material they are learning. In addition, comic also helps teachers in teaching and learning process because it can be an alternative in the choice of teaching media and it makes teachers conveying material easily. Then, it can create a lively and fun learning atmosphere. The exercises contained in the comic can also be a benchmark for students so that teachers can evaluate the used of comic in teaching and learning process.

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Comparison Of The U.S Tennessee Valley Authority And The River Basin Development Authorities In Nigeria

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Abstract- The role of the River Basin Development Authorities is to bring about rapid economic development to Nigeria by harnessing water resources in various regions to promote agricultural development through large scale irrigation projects and general water management. Though various achievements have been recorded, evidence reveal that RBDAs in Nigeria have not led to appreciable economic development. Using a comparative approach, this study reviewed the TVA as a successful model and novel concept in river basin project to compare the RBDAs in Nigeria. The study concluded that lack of institutional interfaces between state structures and RBDAs is responsible for poor organization of the RBDAs. The study also recorded variety of other factors also affecting the RBDAs in accomplishing its objectives.

Index Terms- Tennessee Valley Authority, River Basin Development Authority, decentralization, regionalism

I. BACKGROUND TO THE STUDY

One of the Key Objectives of economic planning is the correction of imbalances in regional development – rapid economic development of backward regions. The idea of creating River Basin or Water Authority in Nigeria evolved from the success of the Tennessee Valley Authority in the United States of America in the early 1930s, with the intent of developing the relatively backward Tennessee region. Therefore, the role of River Basin Development Authorities in the economic development of Nigeria is to undertake the development of water resources in various regions, promote agricultural development through large scale irrigation projects and general water management germane for Nigeria’s rapid national socio-economic development. Though various achievements have been recorded (Danladi and Naankiel, 2019), majority of studies reveal river basin development authorities have not led to appreciable economic development. Thus, the need to understand the causes of failures in river basin projects in Nigeria have continued to agitate the mind of researchers. Danladi and Naankiel (2019) adopted a multidisciplinary approach of using both primary and secondary sources to show that corruption, mismanagement, politicization of agriculture, poor funding and insecurity are responsible for the poor economic development of river basin in Nigeria.

Okeola and Balogun (2017) used exploratory reviews of Federal Government of Nigeria’s gazettes, agencies reports, intergovernmental documents on water resources policy as primary data source and publications by academia to identify contradictions and overlapping statutory responsibility constitutes policy implementation impediments to effective and efficient river basins operations. Akindele and Adebo (2004) adopted a comparative approach, this study reviewed the TVA as a successful model and novel concept in river basin project as against the River Basin Development Authority’s in Nigeria. Based on the above short comings, this study will attempt to provide answers to the following questions;

1) What is the regional context guiding the preparation of regional plan and the country policy towards regional planning of the TVA (USA) and RBDAs (Nigeria)?
2) What is the rationale for the establishment of the TVA and the RBDA’s and its implication on the success of river basin projects?

II. CONCEPT OF REGION

As recorded by Vulkovic and Kochetkove(2017), the term region does not have a clear definition. Due to its multifaceted nature, it certainly has natural, cultural, economical, political and social dimension. At the same time, this term occupies a wide range of phenomena from small parts of countries to huge continental interstate formations. Regions have been considered differently by different researchers belonging to various disciplines. And while doing so these researchers tended to conceive regions in the context to concepts pertaining to their own disciplines. An idea of this variation in thinking and conceptualization of regions can be had by looking at what a sample of thinkers have to say in this regard.

UNCRD (2013), defined a region according to the issues being addressed. And there are different scales in both governance and issues of concern.

Oluedere (2011), streamlined the numerous views of scholars on definition of region into two: objective and subjective views. The objective view according to the researcher, claim that a region is a real entity that can be physically identified and mapped. This view follows Henderson (1905) cited in Oluedere (2011), that Posit the entire world can be divided into natural regions on the basis of four criteria namely; land configuration climatic conditions, vegetation types and natural resources. Equally, Goh Cheng-Leong and Adeleke (1978) cited in Oluedere (2011), divided the whole world into 12 climatic regions based on:
distinct latitudinal locations, climatic conditions, natural vegetation types and natural resources.

The subjective view consider region as an instrument for spatial segregation. Thus Oluadare (2011), posit that regions are descriptive tools, defined according to particular criteria, for particular purpose. There can be many regions as there are criteria to define them.

DRD (1984) defines region as any subnational area that a country calls a region for purposes of planning or development. A region may also comprise parts of more than one country.

### 2.1 Planning Region

According to Chandna (2016), the planning region is an areal unit which is deemed fit for the purpose of regional planning and is a distinctive area in itself while being part of the spatial whole. Its relationship with the spatial whole could be best compared with the relationship of any sub-system of the human body such as the nervous system or digestive system or any other sub-system with the body whole. As each sub-system of human body is distinctive in itself and yet is not independent of the body whole, in the same way, a planning region is a distinguishable unit of area due to its own characteristics and yet does not exist in isolation from the spatial whole. Nothing can happen in a region without affecting the other area in the same way as anything going wrong with the digestive system affects the functioning of the whole body.

It implies that a planning region is a region in which the whole is related to the part in the same way as the part is related to the whole. It has the functional unity of the kind as displayed by a city region say the Port Harcourt (Nigeria); it has the similarities of problems and the potentialities of the kind as displayed by say the Niger Delta (Nigeria); it has the economic unity of the kind as displayed by say the ECOWAS sub region(West Africa); it has the social unity of the kind as displayed by say the Yorubas in the South West of Nigeria. Thus, a planning region is a self-created living organism having a life line which not only does support the life in the region but also radiates unifying forces that enable the region to be a unified regional space so as to facilitate the practice of regional planning (Chandna, 2016).

Such a conceptualization of planning region implies that a planning region should have the following characteristics: neither too big nor too small a size; flexibility of its boundaries; contiguity and compactness of its shape; natural cohesion; economic harmony; social harmony; functional unity; similarity of its problems; regional consciousness and administrative convenience to widen the existing disparities between one part of a country and other.

Regional economic planning is best viewed as a component of national economic planning and overall national economic policy (Glickman, 1977). This follows that Regional Planning is planning for development of a region which is demonstrated on geographical or economic consideration and is designed for the development of the resources of that region (Tungare, 1969). In such a concept, the plans are conditional because they give physical situation, natural resources and the levels of socio-economic development already reached and that the plans are drawn up for the development of the potential of the region.

According to Chandna (2016) regions operates in a distinctive environmental setting characterized by the comprehensiveness of regional space. In addition, it has a distinctive scale of operation. However, the scale at which its actions take place cannot be standardized. It may vary both in time & space. Furthermore, it is distinctive in the sense that it is a coherent corpus of thought and action translated into regional reality. According to Chandna (2016), each region or a planning unit is unique and as such each regional plan too has to be of its own type. It means that there can be no standardized regional plan which could be applicable even to similar type of physical/natural region say basin regions in different basins in the same country. Each regional plan has to be guided by regional context of its own as well as by the planning policy, which may vary from country to country.

The planning policy of a country becomes the starting point of any regional planning exercise as it provides an impulse to the plan. Therefore, no regional plan could be studied and evaluated without the preliminary understanding of the problems associated with the starting point i.e., the regional context and planning policy of the concerned country. That will determine the objectives, the design of the plan and the planning process. The context in which each regional plan has to be prepared necessitates different approach to regional planning in each such case although with the common objective of cultivating habitability in the regions of human occupation.

As observed in the foregoing paragraph, each region or a planning unit is unique as such, each regional plan has to be of its own type it means that there can be no standardized regional plan which could be palpable even to similar type of physical/natural region. Each region plan has to be guided by regional context of its own as well as by the planning policy of the country, which may vary from country to country. However, this conceptualization of regional planning, will be used in this work.

### III. CONCEPT OF REGIONAL PLANNING

In the literature, several definitions of regional planning have been made. Accordingly, regional planning is imperative to the economic development of a region (Srinivasan, 1971). In such conceptualization, there is a strong belief that regional planning secures the best conditions and possibilities for an all-around development by minimizing and ultimately eliminating inter-regional and intra-regional difference.

According to OECD (2000), attention to problems on a regional scale provides a means of counteracting centripetal forces inherent in economic and technological development which tend

### IV. SYSTEMS THEORY

David Easton’s system theory of 1965 is a system analysis of political life (Sorka, 2007). Furthermore, Sorka (2007) affirms that the theory views organisation as having parts closely related and linked to each other and having a give and take relationship among the parts working to ensure stability of the organization. As a consequence, the parts carry out functions efficiently and effectively to ensure continuity and survival of the system. The theory further implies that the environment has a crucial role in determining organizational performances. It seeks to find out which aspects of the social system influences organizational
performance overtime thereby enhancing the ability to account for change and development.

David Easton who adopted system theory to administration in 1953 conceived that a political system could be seen as delimited (with boundaries) and changing.

The System Theory arose out of the need to provide explanations on aspects of workings of organization not covered by the traditional classical and other theories of administration. The system as a concept is derived from the biological sciences meaning a whole with interrelated parts. Ogunbaremu (2004) views the system approach as exhibiting features of holism or synergy hierarchy of parts which work harmoniously for the attainment of goals of the higher system and are equally affected by the alteration in one of the parts. The model uses as its major unit of analysis the political system in which political life is viewed as a system of behavior. Political systems are defined by Easton as a set of interactions, abstracted from the totality of social behaviour, through which values are authoritatively allocated for a society. In this definition, there are a number of assumptions that lend direction to systems analysis. For one, the emphasis is on interaction as a variable.

Interaction may take place between individual actors, institutions or actors and institutions collectively interacting with others. Easton recognized that there was no single way of conceptualizing human behaviour, which could properly encompass the variety and behaviour therefore, must be quite general and broad in nature. A system is presumed to be analytically distinct from its environment. Although an analytical distinction is made between the system and its environment, the system is open in varying degrees to influences from the environment. Indeed, the nature of environmental influences and the ways in which the system responds to them is one of Easton’s major concerns. In separating a system from its environment, however, we refer symbolically to the system boundary. The nature of systematic boundaries, how they are defined and their degree of flexibility or rigidity are major problems facing systems theorists. If we assume that systems are susceptible to varying degrees of influence from the environment, and that systems may affect their surroundings, we must make reference to the inputs, outputs and feedback variables.

The main assumptions of system theory were:

(a) Inputs – The system theory assumes that there exist inputs made in the organization from the environment and sometimes from within the organization.

Here the demand for the provision of certain facilities by the public would be explained as inputs into the government or its agencies. It could also mean the public making inputs in terms of advice for government agency to succeed achieving set goals. Provision of resources by government for execution of planned programmes is also considered as inputs.

(b) Conversion Process – The system theory believes that inputs made into an organisation need to be processed and converted as outputs. The manner in which the conversion process responds to the inputs depends on previous antecedence and inclination to follow the antecedence. The central issue here is the management willingness to commit allocated resources to planned programmes.

(c) Output – This connotes rendering services or executing desired programmes. In public organisation it may also involve the decision and policies made by the Government.

(d) Feedback – The system theory assumes that the organisational system would send back information into the environment and also receive further inputs as response from the environment. Thus, execution of programme or provision of certain services by the organisation based on demand (input) from the environment would further receive (feedback) responses in term of acceptance, rejection or demand for improvement from the environment.

3.1. Systems Approach to Regional Management

The forms and methods of management of a social or economic system are always largely determined by the goals, structure, and functions of this system. The management system or managerial bodies reflects the characteristics of the system to be managed and is itself an integral part of it (Knop, 1979)

A regional system is characterized by the social and economic units acting as part of this system, their roles and interrelations. The main functions of a regional system occur in:
- Social services to provide health care, education and information;
- The circulation and distribution of goods and financial funds;
- The protection, conservation, and development of the natural environment and available natural resources.

These programmes or services rendered by the management system or organization are the inputs made into the regional system (Knop, 1979)

These activities are performed in specialized units - factories and plants, transportation enterprises, social service utilities, institutes, and settlements and these constitutes the component parts of the system.

A regional system is also characterized by a wide variety of social and political groups, whose nature varies in accordance with the national sociopolitical structure. Each group in any national setting, however, represents an individual set of social, economic, and political interests in the region. The interaction among these groups and their differing levels of influence determine the goal-setting process and priorities for the future development of that region (Knop, 1979).

Systems elements of regional management include:

Managerial bodies dealing with regional planning and management, such as Federal, state, county, and city governing parliamentary bodies; Governing agencies; Management of nationalized enterprises; - Management of cooperatives; - Management of private enterprises; Management of social service units.

The management of regional development dwells on the degree to which these managerial bodies interact and to which it can be guaranteed to streamline all activities in the direction of a complex, unified, and harmonious development of the region. This requires, in many cases, a certain centralization of regional management functions and the creation of specialized organizations to perform these functions.

V. CONCEPT OF DEVELOPMENT

According to Omuta and Onokerhoreye (1994), there is no universal definition of the term development. Some definition is
based on economic criteria, some on social conditions, while others are based on political considerations. Other researchers like Chandna (2016) have included aside the list above, political consideration, historical and geographical views.

The economist view development in terms of economic progress expressed in terms of enhancement in the standard of living of people in general, or enhancement in general productivity level per capita income, efficiency of a worker and overall improvement in quality of life in general (Chandna, 2016). The economist concept of development revolves around economic growth, economic planning, and economic policy. Most economics are of the view that if an economy is growing, say at the rate of 3 percent per annum then the general socio-economic well-being of the population will improve. (Omuta and Onokherhoye, 1994). However, the economic growth and development can only come about through good economic planning and economic policy.

Sociologist, on the other hand believe that economic development was of little relevance in the absence of social development. According to Deutsh (1971) as cited Omuta and Onokherhoye (1994), development encompasses numerous processes of change which are frequently associated. These include spatial mobility, occupational changes, changes in roles expectations, needs, behavior, associations, family, marriage etc. Consequently, the societies have been classified by the sociologists into folk, agrarian, industrialists, on the basis of respective social structures. The two most significant parameters of measuring social development include quality of life and social justice (Chandna, 2016). The quality of life in this context is measured in terms of social harmony and social cohesion and social justice that has its focus on equal rights and opportunities to all segment of a society.

The political scientists’ conceptualization of development has its focus on political context, each political setup, according to Chandna (2016), shall have its own political structure and hence political economy. This justification is seen in the increasing role of government not only as promoter but also as the principal planner. Thus, power structure holds the pivotal position in political scientists conceptualization of development.

The geographer conceptualizes development as much more comprehensive. The geographer considers development in terms of regional development covering economic progress, social advancement, political development and environmental preservation (Chandna, 2016). Economic progress can usually be measured by progress in; standard of living, per capita production, per capita consumption, degree of manpower utilization, extent of diversification of economy, etc.

The measures of social advancement lie in quality of life, social harmony, social cohesion, social justice, etc. Political development of a society finds its experience in the degree of decentralization of power, administrative efficiency, and degree of participation of the general masses in welfare activities. Environmental Conservation usually refers to the state of ecological balances and the state of environmental degradation in terms of soil erosion atmospheric pollution, water contamination, wildlife conservation, noise pollution, preservation of biodiversity, etc. apart from the unique synthesis of physical, social and economic development conceptualize by the geographer, the main thrust of geography, however is on the spatial perspective of development.

All of the above definitions of development are quite relevant to the regional analyst and planner who is primarily concerned with the spatial aspect of development. The regional planner/analyst is interested in how economic, development, social development and political development, etc. are reflected in space. This study will dwell on the geographic concept of development due to its all-encompassing nature.

3.2. Theories of Development

Within the discipline of Economics, there is a subcategory development, which is somewhat new. It seeks to apply identified tools and approaches to the economic, social and institutional aspects of developing countries in order to achieve improvements in the standard of living (Todaro 2000) cited in (Shareia, 2015). The focal point of this kind of economics is the economic condition of developing countries regarding these matters and the development of policies that improve a nation’s position economically, socially and institutionally.

Theories of Development were revitalized by happenings in the mid-20th century when decolonization occurred and the economic disparity between European and underdeveloped nations became obvious. Others believe that it is more accurate to evaluate economics as a general provider of organized systems (Todaro, 2000). Consequently, social, economic and political aspects are included in theories of economic development, which apply different models related to different key concepts (Martinussen 1997; Roberts and Hite 2000) cited in (Shareia, 2015). One effective method through which the differentiation between various theories can be recognized is by their classification, based on the primary concept each theory identifies as the driver of economic development, whether internal or external. Several definitions exist for development and offer different focal concepts. For instance, the regional approach and the integrated approach has a primary concept of harmonious development of man and natural resources implemented at a regional level. While the industrial model of growth is of the view that development involves a transformation of a traditional or pre-capitalist Social formation to a Capitalist Social formation, with the type of technology and social organization that characterized the advanced industrial and post-industrial Nations.

However, the study of these different approaches is very important to the development planning of a region, because, the rationale for establishment of managerial bodies such as the River Basin Development Authorities in Nigeria and the Tenessee Valley Authority in USA is based upon.

3.2.1. Industrial Model of Growth

This model is of the view that development involves a transformation of a traditional or pre-capitalist Social formation to a capitalist Social formation with the type of technology and Social organization that characterized the advanced industrial and post-industrial nations (Chew and Lauderdale, 2010). Details of such views on development can be found in the works of W.W. Rostow (Rostow, 1962). The theory implies that 3rd world countries which are linked to the world capitalist system through colonialism and since independence through loans and Multi-
National companies and the growing indigenous capitalist should adapt the technology of the developed capitalist countries like Japan and that this will make for their economic growth. Several Scholars have in recent time criticized the views of development implicit in the classical theories (Chew and Lauderdale, 2010)

3.2.2. Regional Approaches to Development

A regional approach to economic development has been widely recommended (Cole, 1989). It is sometimes seen as a strategy for scarce resources in such a way as to produce both economies of scale and external economies. The regional approach may also be recommended in nations featuring significant spatial differences in resource endowments, population characteristics, and cultural heritage (Oxendine and Disinger, 1989). In such cases it often appears appropriate to tailor special development programs to the unique attributes and requirements of each region. A regional concentration of resources is also appropriate where one or several areas of a country lag significantly behind the rest (Oxendine and Disinger, 1989).

Another theme of economic development is the integrated approach to rural development. Proponents of this approach define rural development broadly. Whereas increases in agricultural production and especially in yield, constitute the centerpiece, many other aspects of the rural sector are considered to be vital to those ends (Oxendine and Disinger, 1989). Rural industry, infrastructure, education, health and the institutional structure of local government are viewed as crucial components of development argue that because the components of the rural sector interact in a circular and cumulative fashion, an efficient approach calls for planning and administering the delivery of component services in coordinated manner (Oxendine and Disinger, 1989).

One practical problem that has faced the regional approach has been the delineation of appropriate regions for development. The regions quite often have been defined along geopolitical boundaries, with the economic rationale as secondary consideration. However, in the case of, taking a river, its principal tributaries, and the accompanying watershed as the developmental focus, the definition of the region is more clear-cut and certain political factors are therefore more easily eluded (Oxendine and Disinger, 1989). Because the river is a prominent factor in ecology of the watershed, a river basin approach also makes it easier than otherwise to ensure that regional development provides for long-term ecological protection.

Finally, the river basin itself and the obvious ecological interrelationships provide an intensity of focus for planning and administration that area likely to be achieved by projects operating on a national scale. It has been observed that whereas village-level, pilot integrated development projects have often proved relatively successful, disappointment has more often been the case at the national level (Ruttan, 1975). An important reason for this disparity is that planning and coordination are carried on at the level of the national government, while implementation takes place in widely disparate regions. The needs at the grass roots may be dimly perceived at the centre, while the ideals and enthusiasms of the planners are diminished as they travel the geographic miles and cultural “light years” to the points of implementation (Oxendine and Disinger, 1989). The village is probably too small in scale for the creation of machinery to plan and successfully integrate the components of development, and the national scale is too large. A regional scale is probably more appropriate in many cases, a region defined by ecological conditions rather than political boundaries may be the ideal.

3.2.3. Decentralization

Decentralization is a form of administrative organization and is defined as an administrative method for the rule of the region, where the central authority transfers some of its legislative, judicial and executive powers to the regions. The constitution establishes the relationship between the state and the regions so that the state exercises sovereignty over it through its basic functions of maintaining security, justice and defense (World Bank, 2001). It can also be said that decentralization is an act by which the central government transfers authority and responsibility formally to actors and institutions at a lower level in a political, administrative and spatial hierarchy (Agrawal and Ribot, 1999). Moreover, transfers a large part of the responsibility for planning and the management then collecting and distributing money from the central government to subordinate or semi-autonomous government organizations that include field units of ministries, units or sub-levels of the government, Semi-autonomous public authorities or units of regional or functional powers.

Decentralization can also be defined as the situation correlating with the participation in decision-making given to the lower administrative levels without ignoring the right of the central authority to make the decision power and powers between the authority and other independent institutions existed in different regions and communities (UNDP, 1999). This means that decentralization is to activate the role of regional and local authorities by assigning administrative and developmental planning tasks that increases their effectiveness and enhances their role in carrying out their responsibilities and powers in a manner that integrates local people into local development processes and ultimately leads to their success.

Many countries adopt system of decentralization at the level of general government administration to achieve optimal levels of public participation in the public affairs of the country (UNDP, 1999). The monopoly of power in the center cannot produce rapid and significant progress and grant wide powers to regions, cities, municipalities and communities that enable people to participate directly in Management of governance processes and merge into the national, political and economic development effort (UNDP, 1999).

Decentralization will preserve the specificities of the ethnic, cultural and reconciliation regions and helps to eliminate the hotbeds of tension resulting from the central imposition policies that negate the self-specificities of local communities, which promotes peace and national coexistence and facilitates merge and participation.

3.2.4. Grassroots Development

The term grassroots imply that planning and decision-making institutions are located within area that is to experience the development, and that local persons and local institutions will be incorporated in some fashion into the planning and delivery process (Oxendine and Disinger, 1989). This is also the meaning of the term participatory development. Both terms imply that a
development cannot succeed without the enthusiastic cooperation of the people who are to experience development.

3.2.5. Regionalism

Odum, describes regionalism in the following 4 points (George, 1955). The first is regionalism as a science. From the various fields of geography, ecology, biology, history, economics, sociology, etc. Natural sciences and social sciences, basic research must be conducted on the inter-functional relationships concerning man and resources, region and culture, physical environment and cultural environment, etc and the collected data analyzed, interpreted and used and through this "region" that allows for the cooperation and arrangement of the above sciences must be selected. Regionalism is, consequently, an integrated science. The second is regionalism as American's frontier. The early period of America’s development was as its name implies, a natural frontier. However, the new frontier of today must be a frontier with a social and cultural meaning. Early frontier involved the exploitation and conquest of nature but new frontier means the development and conservation of nature. Consequently, a planning region calls for a region that can discover a new balance and equilibrium through the redistribution of population, wealth and opportunity. The third is regionalism as a means and technique of administration. Regional development encourages decentralization and moreover since development planning, temporally and spatially, is flexible in character, development administration demands a special technique. Regionalism is an answer to this. Therefore, a planning region must correspond to this technique. The fourth is regionalism as a motive and goal. Development planning must activate the region's growth and stimulate their desires to positively participate in development activities. Due to this very fact, democratic ideas must first be realized, and this requirement is found in regionalism itself. These are the 4 points on regionalism by Odum (George, 1955).

VII. THE REGIONAL CONTEXT GUIDING THE PREPARATION OF REGIONAL PLAN

3.3. Tennessee Valley Authority (TVA, USA)

At the beginning of the 1930's, the USA was suffering from an economic depression that affected all aspects of national life: political, economic, and social. Unemployment was widespread. The situation was aggravated by the many farmers who, having lost their property migrated to the urban areas. Living conditions for a sizeable proportion of the population were very poor. Even in such conditions the Tennessee Valley was one of the poorest regions from practically all economic and social aspects:

- The per capita income of the population in the region as a whole was only 45% of the national average ($168)
- More than half of the 3 million people were employed in farming, and farm incomes were low. Crops suffered from an uneven climate, endless rain alternating with extremely dry periods. out of a total of 14 million acres of open land about one half was abandoned or severely damaged by erosion
- Only 12% of the labour force were employed in manufacturing as compared to the national average of 22%
- Almost 8% of the population were illiterate and the labour force was generally unskilled or semiskilled. People suffered from malnutrition, pellagra and malaria.
- The Tennessee river, the fifth largest in the United States by flow, carried only 32,100,000-ton miles in 1933. The huge potential from hydroelectric power production was practically unused; the installed generating capacity was less than 500,000KW.
- Frequent destructive floods were a disaster for the people and the region (the flood in 1967 at Chattanooga, Tennessee, caused damage amounting to approximately $500 million). 1933, although the provided the regions greatest opportunity, it was the source of the scourge of the land.
- Malaria scourge in the region

However, the above conditions present in the Tennessee Valley Region formed primary goals that led to the establishment of the TVA.

The TVA act was the document that defined the principal objective to the establishment of the TVA. Going by the act, the development of the Tennessee and its tributaries will improve
navigability and control flooding. Flood control would be achieved by the construction of dams, water reservoirs, and channels. These facilities together with the construction of power station, power structures, and transmission lines would be used to achieve hydroelectric power production. The development of the TVA itself was expected to be the basis for achieving:

a) The development of agriculture in the valley, by water supply and the application of fertilizers,
b) The development for fertilizer production in the valley to supply local agricultural needs,
c) Reforestation of the valley and development of recreation facilities.

The combination of these objectives makes it clear that from the beginning the overall goals of the Tennessee Valley Authority was the unified, multi-objective development of the Tennessee Valley.

3.4. River Basin Development Authority (RBDA, NIGERIA)

The establishment of the various River Basin Development Authorities in Nigeria started in a series of agricultural development strategies put in place through different agricultural reforms/policies and programmes. The River Basin Development approach is a realization in the 70’s by the Nigerian Government that the strategy of direct agricultural production was not yielding the desired result. So, there was gradual shift to an agricultural development approach which involved the adoption of an integrated rural strategy (Olayemi, 1998) cited in (Ugwu and Kanu, 2012). Under this strategy, rural development is seen from a holistic perspective with agricultural development problems being only part of a larger rural development concern. This prompted the government, to embark on multipurpose rural development programmes. Aside the River Basin Development Programmes, others include the Agricultural Development Projects (ADP’s), Food, Roads and Rural Infrastructure (DEFRRI), the National Agricultural Land Development Agency (NALDA), Operation Feed the Nation (OFN), Green Revolution (GR) etc.

In 1973, two basin development authorities were established. These are the Sokoto-Rima and Lake Chad Basin Development Authorities. The preamble of the law establishing the two RBDA’s assigned the following objectives to the RBDA’s to be accomplished most expeditiously for revitalization of the country to eleven. During this period, the country was experiencing oil boom following the discovery of oil in the country. However, the oil boom came with sudden and unexpected wealth which seriously undermined the status of agricultural production and regrettably, succeeded in creating utter neglect for and relegation of agriculture to the background (Akindele and Adebo, 2004). As reported by Bamisaye (1985) and cited in Akindele and Adebo (2004), the declining rate of agricultural production was about 7.8% between 1970 and 1974 had reached an intolerable 1%.

Other reasons for establishing RBDA particularly in the Niger Delta region, was due to environmental degradation brought about by exploitation of oil and gas in the region. Going by the law establishing the Basins, it is expected that;

a) There will be improved agricultural development through provision of water for irrigation (to ensure all-year farming) fisheries projects, mechanized farming and livestock development.
b) Improvement of navigation, hydro-electric power generation and encourage the establishment of industrial complexes that could bring about privat and public sectors in join business partnerships.
c) Construction of dams of varying sizes to compound water to achieve objective (a) & (b)
d) Flood and erosion control will also be achieved through the construction of dams.
e) Pollution control.

The objective of the programme was later extended to other areas most importantly to production and rural infrastructure. In 1981, under the military leadership of Mohammadu Buhari the eleven Basin Authorities were metamorphosed into eighteen authorities and was redesigned as Basin and Rural Development Authorities with one serving the purpose of each state and one for Ogun and Lagos state combined.

The main goal and objective are the same as outlined in the 1976 law establishing the eleven RBDA’s. However, the increase of the RBDA’s from eleven to eighteen was aimed at decentralizing the authorities and bringing her functions and activities closer to the rural populace.

However, the restructuring of the RBDA’s did not last as a new regime reverted it back to the previous eleven. The government also stripped the RBDA’s of their full embracing functions except the provision of water resources.

VIII. PLANNING POLICY OF THE COUNTRY

In the course of regional planning, each regional plan has to be guided by the regional context of its own. These include environmental peculiarities and as well as the socio-economic and political development in the region. However, the planning policy of the country will also serve as a guide to the regional plan. The planning policy of the country will determine the objectives, the design of the plan and the planning process. This section will consider the country policy that have defined the development of TVA.

3.5. Tennessee Valley Authority (TVA, USA)
The creation of the TVA followed the planning policy of the United States as at that time. From literature, the planning policy of the United States prior 1930’s, was the building up of military strength. This became critically important in 1916, during World War I prompting Congress to pass the National Defense Act, authorizing the construction of nitrate plants, a process for which abundant electric power was essential. However, in 1917, President Wilson chose the Muscle Shoals site for two nitrate plants, and a dam (Wilson Dam) to supply the hydroelectric power to operate them.

During the period of 1933 to 1935, President Franklin Roosevelt enacted the New Deal policy. It was a series of programs, public works, financial reforms, and regulations embarked upon in the USA. It responded to needs for relief, reform and recovery from the Great Depression that affected all aspects of political, economic and social life of the USA beginning from the 1930s. Concern for food productivity is shown in the Agricultural Adjustment Act which offered farmers subsidies in exchange for limiting their production of certain crops.

Also, of concern is the scourge of malaria, which was reported as 3.7 deaths per 100 000 Americans in 1933 (Sledge and Mohler, 2013). Of this record the Southern part of the USA which comprises the Tennessee region is most affected. Following the enactment of Agricultural Adjustment Act, it will be possible for the acquisition of artificial impoundments along the Tennessee river and its tributaries of notorious mosquito breeding areas. This policy will also help in the relocation of people from such areas after acquisition.

The country problems that led to establishment of the TVA can summarily be stated as:

1. The economic crises of the 1930s, which provided the impetus leading to the creation of the TVA
2. Participation in world war II, which greatly increased the need for electric power
3. Rapid post-war economic development, which stimulated demand for greater power production by the TVA
4. National trends in environmental control in the 1960s which initiated the changes in TVA to develop recreation, demonstration and conservation facilities.
5. Present energy crisis, which causes the TVA to greatly increase the energy production and to search for new energy options
6. The devastating effect of malaria, in the south of the United States i.e. Alabama State, which was controlled by creation of TVA.

By the 1950s, the TVA has achieved the objectives of possessing a very important tool for regional development-cheap electricity in combination with waterways network and recreation facilities. This attracted private industries to the region, resulting in population immigration and the growth of new cities, etc. this led to the economic development of the region.

3.6. River Basin Development Authority

3.6.1. Sokoto RBDA & Lake Chad RBDA (1973)

Some of the changes that led to the present Sokoto-Rima RBDA and Lake Chad RBDA goal structure include the following:

- When the war ended in 1970, Nigeria leaders adopted a policy of “No Victor, No Vanquish” and embarked on a process of Reconciliation, Reconstruction, and Rehabilitation aimed at rebuilding shattered confidence and re-engaging Nigerians in accelerated development of their country.
- The FAO and Michigan university studies drew attention for increased food production.
- The unexpected natural disaster, the Sahelian drought of 1972 – 74, which caused untold production setbacks and leading to local shortages of staples like, yam, cassava, maize, sorghum, millet and cowpeas.
- The rapid urbanization fueled by rural urban migration and a large number of demobilized soldiers after the war.
- In order to re-engage many people in productive enterprises, farming was identified as a likely have for unskilled labour that was available then.

3.6.2. The Eleven River Basin Development Authorities (1976)

The main country policies that define the establishment of RBDA are,

- The attention given regional development in the third national plan. Prior to 1975, regional planning received very scanty attention in Nigeria’s development planning effort. This neglect of regional development planning which is not contained in previous national plans was identified as one of the main weakness of Nigeria’s planning effort, hitherto which has been mainly focus sectoral and financial planning. The objective of this policy thrust is to ensure uneven development amongst the states in Nigeria and by extension, to reduce uneven development in the country.
- The creation of states in line with the policy on regional development planning.
- The various agricultural policy objectives that targeted nutritional requirement of the population, rural employment and institutional environment conducive to participation of private economic agents (Garba, 2000).
- The concern for food shortage expressed in various government policies and programmes such as Green Revolution (GR), Operation Feed the Nation (OFN) and National Accelerated Food Production Program (NADPP), Agricultural Development Projects (ADPs)

3.6.3. River Basin Development Authority (RBDA, 1976)

The major factor that influenced the development of the 1967 establishment of the RBDA was to accelerate agricultural development which has declined after the oil boom. This is to be achieved through dam construction, which will improve water storage for irrigation, rural development and improve navigation. The main country policies that define the establishment of the RBDA are

1) The 1975 third National Development Plan observed that one of the weakness of Nigeria’s planning effort hitherto, has been its heavy emphasis on sectoral and financial planning. Therefore, its main focus during the planning period is to reverse this trend by paying great attention to regional development. The objective is to ensure even development amongst the states in Nigeria and by extension, to reduce uneven development in the country.
2) The creation of states and LGA’s which is considered to be the cornerstone of Nigeria’s regional development policy. States and LGA’s are considered important for the promotion of development.

3) In Nigeria, the concern for food shortage has been expressed in various government policies and programs such as Green Revolution (GR), Operation Feed the Nation (OFN) and National Accelerated Food Production Program (NADPP).

3.6.4. River Basin and Rural Development Authority (RBDA, 1983)

Some of the changes that defined the goal that structured the RBRDA in 1981 are:

- The rapid decline in agricultural production with large supply gaps with attendant rapid increase in food imports from 7.7% in 1970 to 10.3% in 1979 (Ugwu and Kanu, 2012).
- 4.0% of Nigeria’s export was made by agriculture in 1980.
- Agriculture sector recorded a negative growth of 2.1% per annum in GDP according to the third national development plan (Ibietan and Ekhosuehi, 2012).
- To tackle these problems, the RBRDA in 1981, adopted some policies before it and came up with new policies.
- Promulgation of land use decree of 1978. Prior to its promulgation different land law operated among the regions of the federation and following the declining contributions of agriculture to GDP in the nearly 1970s experts observed that peasant agriculture was the problem to increased agricultural output.

3.7. THE RATIONALE FOR THE ESTABLISHMENT OF THE TENNESSEE VALLEY AUTHORITY (TVA, USA) AND THE RIVER BASIN DEVELOPMENT AUTHORITY (RBDA, NIGERIA)

3.7.1. Tennessee Valley Authority (TVA, USA)

In a regional system, the management of regional development dwells on the degree to which various managerial bodies interact to guarantee streamlining of all activities in the direction of a complex, unified, and harmonious development of the region. The establishment of the TVA followed a careful interaction of all the existing managerial units as characterized in a regional system by a wide variety of social and political groups, whose nature varies in accordance with the national sociopolitical structure, that results in output of the system, which culminated in decision and policies made by the Government.

The TVA model follows the integrated approach to rural development. In this approach, resources, rural industry, infrastructure, education, health, and institutional structure of local government are viewed as crucial component of development. The TVA model has been recognized as an integrated development of a geographic region (Cole, 1989). From Franklin D. Roosevelt’s 1933 message to U.S congress advocating for the creation of the TVA to the Authority’s most recent Annual Report, a constant vision has existed of the possibility of utilizing public powers for the purposes of developing natural resources, fostering economic development, and enhancing the quality of human life, all within the context of a democratic, participative partnership among regional organizations, local government, voluntary associations and the people of the Tennessee Valley (Cole, 1989). The TVA idea according to Cole (1989) was held to involve the unified development of man and resources. Furthermore, basic resources were land (including minerals), water and people. The TVA approach called for the integration of these resources in a fashion that would achieve harmonious development of the whole that would enhance the well being of each of the parts (Cole, 1989). However, the TVA model has successfully utilized water resource from the Tennessee River to bring about development in the region. At the time of the TVA’s inception in 1933, its service region was among the poorest, least developed, areas in the USA. By 1950s the TVA was well established both regionally and nationally. Within a period of 20years (1932-1952), several of its achievements had become known and had attracted attention beyond national territory (Chandna, 2016). Part of the success of the TVA, was the application of placed based policies by the government of the United States. Such policies according to Kline and Moretti (2013), have arguably become the de-facto industrial policy in the United States and are also widespread in Europe and Asia. Also as recorded by Yamamura and Masaaki (1984), during the great depression in 1929, business over-centralization resulted in power going to the centre, local business was choked and great losses were incurred by powerless municipalities due to remote control.

The TVA as part of its success story has also heavily emphasized on decentralization. As identified by Yamamura and Masaaki (1984), one of the guiding principles of TVA is decentralization. Its structure makes it unique among federal agencies in the USA. TVA is an independent agency and not part of any federal cabinet department. The TVA Act provides it with the administrative freedom to meet the special requirements of its programme and to adopt the methods of administration of successful private as well as public enterprise (Bos, 1990). All powers of the corporation are vested in its three-member Board of Directors, which reports to the President of the United States. The President, with the consent of the Senate, appoints the members of the Board to serve in nine-year overlapping terms of office. He designates one member as Chairman (Knop, 1979)

The purpose of the methods of decentralization is to provide greater opportunity for a richer, more interesting and more responsible life for the individual and to increase his genuine freedom and his sense of its own importance (Yamamura and Masaaki, 1984) .

The congress of the United States established the TVA as a national agency, but one confined to a particular region. This provided an opportunity for decentralization. A limited region, it outlines drawn by its natural resources and the cohesion of its human interests, was the unit of federal activity rather than the whole region (Yamamura and Masaaki, 1984).

To make possible for citizens of the region concerned to hold decision-making power and participate positively in TVA, TVA’s headquarters was established not in Washington but in Knoxville (Yamamura and Masaaki, 1984).

The concept of decentralization, also involves the trend, grassroots development. This approach was adopted in the
establishment of the TVA in order to achieve tenable development. Thus, the implementation of TVA projects calls for the integration of highly specialized professional and technical land development through the unity of man and resources. These professionals and technicians do not only have a wide insight on matters outside their realm, but recognize the relative importance of their own work, and those selected are also able to evaluate the value of other work when compared with their own. Otherwise, the very fact of the highly specialized men may endanger the fulfillment of the common purpose of development through the unity of man and resources. Therefore, the TVA Board exchanges views with the professionals and experts, introducing specialized views on wider public interests - the welfare of the valley inhabitants.

With this TVA objective, professionals and technicians engage in the projects were able to expand their views and scope of their own specialty, and welcome interdisciplinary links with other fields. This is further extended to administrators, implementators, and the region's inhabitants. In other words, the unifies development of resources must become the common purpose of all the people and all the agencies of the entire valley, otherwise the objective if TVA would not be fulfilled.

Closely, related to decentralization, is concept of regionalism. As described by Odum (George, 1955)M regionalism is an integrated science and a means and technique of administration. Modern regionalism according to Yamamura and Masaaki (1984), rest squarely upon the supremacy of the national interest. They further propose the harmonization of the regional advancement with regional resources. The concern for supremacy of national interest distinguishes regionalism from sectionalism. To this end, the TVA toed the line of regionalism. For example, to create it, seven states did not unite to demand special privileges to distinguish them from the country as a whole, regardless of the ensuing consequences to the national welfare. A federal legislature itself created the TVA as an autonomous regional agency whose basic objective was to conserve the natural resources lying in the valley of the Tennessee and to develop those resources on conformity with broad national objectives and policies.

3.7.2. River Basin Development Authority (RBDA, NIGERIA)

The establishment of the RBDA in Nigeria follows the development theory of industrial model of growth. This theory is of the view that development involves a transformation of a traditional or pre-capitalist social formation with the type of technology and social organization that characterizes the advanced industrial and post-industrial nations.

This view follows an attempt to solve food supply problem in Nigeria by adopting a Western system of agriculture development. This entails the belief that the traditional system of agriculture must be eliminated and must be substituted with Western capital – intensive agricultural systems based on the use of dams, tractors, harvesters, fertilizers etc. to translate this development path into reality the Nigeria government established the various RBDA’s.

However, it is obvious that Nigeria’s attempt at solving her food and agricultural problems are based, not on carefully thought-out plans, that build on existing strategies but on ad hoc plans and experimentations with River Basin Development Authorities. These are based on imported ideas and technologies which documented records show have not been very successful in Nigeria. For example, Modo (1983), in a research to examine the impact of river basin development authorities on Nigerian development authorities on Nigeria development, showed that the modern agriculture techniques led to submergence of old Maradun civilization. These techniques were not only recommended by F.A.O experts in its implementation but have also been influenced by F.A.O experts in its implementations. As a result, the Sokoto Rima Basin Development Authority which happens to be the case study here, imported machines, tools fertilizers etc. through transnational corporations. This imported strategies and technologies get progressively modified or abandoned with the emergence of new regime in a perennially politically unstable situation that has continually plagued the country. For example, the Babangida administration stripped the RBDA’s of all their functions except water resources, despite the RBDA’s obviously still struggling to achieve their goals.

Available and documentary evidence, Modo (1986), support the contention that, as with the indigenous Gungawa ethnic group of the Kainji dam site, the old agricultural practices of old Maradun met the food needs of the people and their neighbors prior to the creation of the dam. The people of old Maradun practiced complex surface irrigation method similar to what Sokoto-Rima River Basin Development Authority later introduced. The society of old Maradun was organized in such a way that its people regularly produced abundant and surplus food to the extent that they were supplying their surplus to cities like Talata, Mafara, Gusau and Sokoto. Indeed, many rituals and taboos existed which were believed to be essential for good annual yields. Elaborating title-taking and social stratification developed around and stimulate healthy competition for the production of surplus. Old Maradun culture thus revolved around hydraulic agriculture and surplus food production.

The RBDA model in Nigeria also adopted the integrated approach to regional development. This is evident in the goals that precipitated the establishment and modification of the various RBDA’s in Nigeria. However, in Nigeria it has been observed that village-level integrated projects have often proved relatively unsuccessful. An important reason for this is that planning and coordination are carried out at the level of the Federal Government, while implementation takes place in at the grassroots. The needs at the grassroots may be dimly perceived at the centre.

The RBDA’s also emphasized on the concept of decentralization. However, unlike the TVA, the RBDA was established as a national agency, but it is spread out in different regions of the country. While the government has a decentralization policy, little actual decentralization has happened (Anselm and Amusa, 2010). RBDA’s are parasastals under the FMWR, established by law, and its operations guided by rules and regulations (Adeoti, 2014). By function (according to the Constitution of the Federal Republic of Nigeria of 1999), the executive implements laws and programs, the legislature formulates laws, and the judiciary interprets laws. By virtue of its creation, the RBDA’s are part of the executive arm of government in Nigeria. Adeoti (2014) emphasized that this mode of operation of the RBDA breeds corruption and political interference. For example, as commented by one of the respondents in Adeoti (2014), “Some of the projects are not actually conceptualised by
the River Basin [Development Authority]. You now have a member of senate or house representatives that comes from a certain constituency putting projects in the budget for you to implement, I mean, no study before, no planning before, you don't have a very clear conception of the project right from the word go, somebody just put it there for you [to implement”]. Furthermore, Akpabio et al. (2008) show that efforts at the CRBDA seem to be directed towards areas with less water problems (the lower part of the basin) than areas with acute water problems (the upper part of the basin). A possible explanation for this imbalance relates to corruption and the politicization of water projects. For example, the lower parts of the basin represent urban settlements which harbour the most influential politicians and top government officials. The ability to influence the location of government projects around their settlements demonstrates their influence and power-wielding capacity.

Also, unlike, the TVA the RBDA is established as an agency of the Federal Ministry of Water Resources. Though, the headquarters of the RBDA are located in the regions, decisions are taken at the Federal capital in the ministry of water resources. The implications here is that, the citizens of the region are not part of the decision making.

The RBDA also adopted the grassroots development approach. Similar to the TVA, the Nigerian model, calls for the integration of highly specialized professionals and technical land development through the unity of man and resources. In order to achieve the objectives of the TVA is expanded to include administrators, implementors and the regions inhabitants. However, in the case of Nigeria, the regions inhabitants are mostly left out, thus defeating the grassroots conceptualization of unifying development of resources for the purpose of all people. This is closely linked to the non participatory approach of top to bottom concept of development adopted by Nigeria, which does not involve inhabitants in decision making. A study by Adekunle, Oladipo, and Busari (2015) recommended encouragement of participatory irrigation scheme (PIM), after recording 78.3% of farmers in the Lower Niger Basin and Rural Development Authority, Kwara State, Nigeria lacked knowledge of irrigation techniques, 76.6% lack access to credit facility and 85.2% acknowledge poor response to farmers need by the Authority.

The RBDA, like the TVA dwell on the concept of regionalism. The establishment of the RBDA by the various administrations in Nigeria laid emphasize on the supremacy of national interest as above regional interest. Obviously, the major goal of the various RBDA is to harness the river resource from the various regions to bring about development in the regions and at the national level.

IX. SIMILARITIES AND DIFFERENCES

3.8. The regional context guiding the preparation of regional plan and the country policy towards regional planning of the TVA (USA) and RBDA (Nigeria)

Similarities
- The primary goal is harnessing of water resource to achieve development
- Development is focused in a region
- The planning region is considered to be a river basin
- The planning policy of both countries determine the goals of the TVA and the RBDA. For example, in the USA during World War I (1916), it became critically important to build military strength. The Sahelian drought in parts of Nigerian and the Sahelian region precipitated the establishment of the Sokoto Rima and Lake Chad Basin Development authorities in 1973.

Differences
- The TVA constitute just a region while the RBDA constitute the development of different regions.

3.9. The rationale for the establishment of the TVA and RBDA

Similarities
- The TVA and the RBDA follow the integrated approach to rural development.
- The TVA and the RBDA both adopted the decentralization approaches to development.
- Both agencies, TVA and RBDA toed the line of grassroots development.
- The concept of regionalism is adopted by the TVA and the RBDA established in the region where the agencies differences are located.

Differences
- The RBDA adopted the theory of industrial model of growth for less developed countries. This model was copied from the developed countries model such as TVA in USA and account for the not too successful nature of the RBDA. The techniques and technologies of the TVA were alien to Nigeria.
- Though both agencies, TVA and RBDA adopted the integrated approach to rural development, the TVA has been acclaimed to be very successful unlike the Nigerian RBDA. This is due to the fact that the TVA was an application of place-based policies practiced by the United States government. In Nigeria, decisions are taken at the national level without considering the inhabitants of the region.
- Though both agencies adopted decentralization as their development policies. The TVA was established as a national agency confined to one region, whereas, the RBDA are spread out in different regions.
- The TVA is an agency of the United States Government confined to one region, whereas, the RBDA is established as an agency of the Federal ministry of Water Resources. The implications is that decisions taken have minimal impact on the people.

X. CONCLUSION

- Lack of institutional interfaces between the state structures and the RBDA is observed to be responsible for poor organization of the RBDA
- Imported strategies and technologies that get progressively modified or abandoned with the emergence of new regime has continually affected RBDA in achieving their goals.
The integrated approach to RBDA development has not been very successful due to the needs of the grassroots not considered at the centre.

Due to lack of actual decentralization, RBDAs breeds corruption and political interference.

Though the Nigerian model adopted the grassroot approach, a non-involvement of inhabitants of the region in decision making has affected the RBDAs in achieving its objectives.

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Evaluation of Methane Gas to Electricity Conversion at Jatibarang Garbage Dump

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Abstract- Garbage was unwanted residual material after the process ends. Garbage was a problem that was often faced by cities in Indonesia. Garbage itself causes pollution around it. Jatibarang Garbage Dump, one of the Garbage Dumps located in Semarang, had a pile of garbage piling up because the amount of Garbage Dumped every day was not comparable to the storage area. One of the uses of garbage was by converting garbage into electrical energy by anaerobic. This gave an additional advantage in the utilization of landfill gas. This study evaluated the utilization of Jatibarang landfill gas in Semarang City which utilized landfill gas to generate electricity through combustion in a gas conversion generator. Semarang has a population of 1.6 million and produces around 1.270 tons of garbage per day, of which around 70% of the waste were transported and discharged to the landfill, estimating gas production of up to 600 m³ / hour which can be converted to 1.2 MW. The landfill gas conversion facility has become operational at the end of 2019.

Index Terms- Garbage Utilization, Waste Power Plant, Semarang

I. INTRODUCTION

Indonesia is estimated to produce 64 million tons of waste per year. The biggest composition of waste is 60% organic waste, followed by 14% plastic waste, 9% paper, 5.5% rubber and other waste such as metal cloth glass and the like (1). Most of the waste generated is disposed of at the final processing site (Garbage Dump) openly, even by combustion which produces highly toxic gases. Garbage is only moved and piled up in landfills. Some dumps are lowland areas outside the city, without certain technical measures as required causing health problems and environmental pollution (9; 8).

One other concern on landfill management is the production of Greenhouse Gas (GHG) emissions due to the anaerobic decomposition process of organic waste. With waste production and composition, Indonesian waste is estimated to produce 88 MTon CO2e GHG emissions, with an average growth of 4% in the period 2000-2012. GHG emissions from waste management will grow 6.3% to reach 296 to 2030. In fact, landfill gas consists of mostly CH4 and CO2 whose production will end until all organic waste is degraded which can last for decades. Garbage Dump gas composition consists of CH4 50%, CO2 40%, and other gases 10% (12). With the characteristics of waste and GHG emission produced, choosing the right technology is needed in order to be able to utilize waste as an energy source (13). Adequate waste processing technology not only reduces environmental impacts but also reduces GHG emissions and saves the use of fossil energy and mitigates climate change (20).

Utilization of landfill gas as energy can replace conventional fossil energy, reducing usage and emissions associated with energy production from fossil energy. This gives an additional advantage in the utilization of landfill gas (7). Several studies have examined the use of landfill gas, for example, estimated gas production (4; 11; 3; 17), the use of technology and its feasibility (10) as well as evaluation of landfill gas utilization (18). Some studies show potential and opportunities, but others show challenges to utilizing landfill gas. This research evaluates the utilization of Jatibarang Landfill in Semarang City of Indonesia, which utilizes landfill gas to generate electricity through combustion in a gas conversion generator. Kota Semarang, with a population of 1.6 million, produces around 1,270 tons of garbage per day, of which around 70% of the waste is transported and disposed of at the landfill (DLH Semarang, 2018). DANIDA (2015) estimates gas production of up to 600 m³ / hour which can be converted to 1.2 MW. The landfill gas conversion facility has become operational at the end of 2019.

II. Research Methods

This research is a type of exploratory research through a qualitative approach, using the case study method. The use of the case study method is driven by research questions that tend to answer the why and how. Case studies are more appropriate to explain why decisions are made, how they are done and what the results are. In addition, case studies are also very suitable for researching contemporary problems and limited levels of researcher control (21). In addition, the authors also want to present research in more detail and in a natural setting (5). The stages of research implementation include:

A. Development of guiding questions

Guiding questions are used as a reference during the interview process. This question is not binding so that it can develop according to the needs and availability of data and information.
B. Identification of sources

The resource persons were identified based on expertise and linkages with facility development activities. Resource persons consisted of the Semarang City Environment Agency, ESP3 management unit, project supervisors, contractors, power plant operators, and experts from the university. There were nine speakers.

C. Interview

Interviews for informants who are in Semarang, interviews conducted face to face or via telephone. Speakers who are outside the region and abroad are done via email correspondence. Interviews were conducted during April 2020. This research is strengthened by a literature review of study reports and the development process as well as observations of the development process and operation of the landfill gas conversion facility

III. Result and Analysis

Jatibarang Garbage Dump is the only Garbage Dump currently operating in Semarang City. The landfill receives waste from 575-800 tons per day during the period 1999-2016 when a feasibility analysis of the use of landfill gas into electricity was carried out. The pre-feasibility study estimates that more than 3.5 million tonnes of waste have been buried in the Jatibarang landfill, especially in cells 1 and 2 that have been used since the landfill was operational. The composition of landfill waste consists of food waste by 43.36%, garden waste by 18.58%. Plastic waste is 13.4% while paper waste is 12.26%. The remainder consists of textile, metal, diaper and other waste (Q2, 2015; Q2, 2016).

The Garbage Dump Jatibarang is designed with the aim to be managed in accordance with the sanitation standards of the landfill site, but during the field visit conducted in July to November 2014 the evidence of the sanitation standard was not well applied. This will cause various environmental problems to emerge which in turn will greatly affect the health and safety of the surrounding community. The area of the landfill reaches 46 hectares but the boundaries of the area are unclear while hilly and valley geographical conditions are difficult to access. The access road is very limited especially during the rainy season.

In the Jatibarang Garbage Dump there are more than 700 cattle belonging to the community at the time of the pre-feasibility study. The number was confirmed around 2,300 individuals during the data collection by DLH Semarang City in 2018. The presence of cows hindered the mobility of vehicles and heavy equipment. The presence of scavengers is also identified which impedes the compaction process by heavy equipment. The operator reported that there had been a number of fires at the Garbage Dump in the past. Most of these are small fires and fires can usually be controlled and put out. The possibility of fire is rampant in the landfill area where the trash is not covered by land and areas that are busy with scavengers. These fires are usually caused by scavengers who smoke and throw cigarette butts as well as burning cables for taking copper as recycled waste (Q2, 2015).

With available waste disposal data and subsequent waste disposal until 2024, the composition of waste and the correction factor of the landfill management system, the energy potential of landfill gas is estimated to reach 600 m3 per hour or a maximum equivalent to 1.3 MW (Q2, 2015).

![Figure 1 Comparison of Potential for Gas Production and Electricity Production in Garbage Dump Jatibarang](image)

The construction of a landfill gas power plant is conducted from October 2018 to December 2019. The installed gas generator capacity is 954 kW. During the final trial process where the electricity buyer requested a 3 x 24 hour endurance test, the power plant failed to meet the requirements. The plant only managed to operate at a capacity of 800 kW for 4 hours. After operating for more than four hours, the landfill gas volume decreases. Likewise, methane gas concentrations decrease below 40% while gas generators require landfill gas inputs with methane gas concentrations of 50-60%.

The power plant from Jatibarang landfill gas finally operates commercially at a capacity of 200 kW from an installed capacity of 954 kW. This decrease has implications for the decline in electricity production from the original projection and in the cash flow of operators (cash flow).
The incompatibility of landfill gas production with the pre-feasibility study (2015) and the feasibility study (2016) can be caused by various factors, which are classified into two. First, the inhibition of the extraction and transportation of landfill gas from the landfill cell to the gas well. The blocked flow of landfill gas can be caused by dirty and clogged gas wells and or the gas well is not deep enough.

The first category is completely explained as follows:

a. Gas age is inhibited by crust and dirt

There is a lag of about six months between the completion of the construction of the landfill gas conversion facility in the Jatibarang landfill and the commissioning process. This time lag causes the facility to not operate optimally. Operation of the facility is only carried out two hours every day to monitor the performance of each system. According to one of the interviewees, gas wells can be clogged with dirt which causes landfill gas from the garbage heap cannot flow, even though it is pumped with a blower. Therefore, all gas wells must be thoroughly cleaned. Although this recommendation has been made, gas production has not shown significant changes.

b. Gas depth is not deep enough

The cause of the mismatch of landfill gas production between the estimates and the actual can be caused by obstruction of the flow of gas in the cell stack to the gas well. Gas wells planted at a depth of 2.5 meters at 10 points are not enough to reach all layers of the garbage pile. The depth / height of the rubbish heap is estimated to reach 15 meters so there is a gap between the lowest rubbish and the tip in the gas well around 12.5 meters. Meanwhile, the pile of garbage has been compacted and covered with soil. With high rainfall, layers of waste within the life of the landfill can be airtight.

Cleaning and maintenance of gas wells is inadequate to reach gases arising from the lowest pile of garbage. These causes require new investment to replace gas wells with longer / deeper pipes. Although this issue was discussed during construction, the deepening of the gas well was not carried out because it followed the agreed engineering design details.

Possible causes of category two stem from the amount and type / composition of waste that is the source of landfill gas formation. According to IPCC (2006), landfill gas production is calculated based on First Order Decay (FOD), where landfill gas that arises is always proportional to the amount of degraded material. The amount of rubbish heap in one year is not associated with the amount of methane gas formed. The potential for methane generation occurs in a certain year and gradually decreases to more than a decade. The FOD model is an exponential function that explains the fraction of material that is degraded to CH4 and CO2.

The amount of landfill gas that is formed is influenced by the amount of degraded organic matter (DOCm) affected by the type of waste. The amount of landfill gas that arises is DOCm which is decomposed and influenced by the weight of stored waste (W), Degradable Organic Carbon (DOCf), decomposed DOC fraction (DOCf), and Methane Correction Factor. The MCF is determined by aerobic decomposition in the year of decomposition. This is influenced by the management of the landfill where the bush is open to oxygen, the MCF value is getting smaller so that the potential for landfill gas generation is also smaller (IPCC, 2006).

Mathematically, the potential generation of methane gas is explained in the following equation:

\[ \text{DDOCm} = W \times \text{DOC} \times \text{DOCf} \times \text{MCF} \]

Where:

- DDOCm: the amount of degraded organic matter
- W: The weight of the garbage is stored
- DOC: Degraded Organic Carbon
- DOCf: The Degraded Organic Carbon fraction
- MCF: Methane Correction Factor

DDOCm shows the total amount of landfill gas. To obtain the amount of methane gas, the CH4 fraction in landfill gas (F) and the molecular weight ratio of carbon in CH4. Mathematically explained in equation (2).

\[ \text{Lo} = \text{DDOCm} \times F \times \frac{16}{12} \]

Where:

- Lo: Potential for CH4 Incidence
- DDOCm: The amount of degraded organic matter
- F: CH4 fraction in landfill gas
- 12/16: CH4 / C molecular weight ratio
This mathematical equation explains that the potential for CH4 gas generation is influenced by the amount of organic waste stored and the landfill management system. PreFeasibility Study (2015) determined the MCF value of 0.4 used for the ratio of open waste management systems without compaction. This value is relatively low compared to Jatibarang landfill waste management practices that are compressed / compacted and sometimes covered with soil. The results of interviews, literature studies and observations indicate that there are allegations mismatch of landfill gas estimates for actual landfill gas generation caused by incompatible waste generation.

This can occur through three causes as follows:

A. The existence of cows reduces the amount of organic waste.

    The 2,300 cows that eat organic waste, especially vegetable and fruit waste from markets and households, can significantly reduce the amount of organic material. Referring to equation (1), the amount of degraded organic matter (DDOCm) will decrease because the weight of stored waste (W) decreases, as will the Degraded Organic Carbon (DOC) and the Degradable Organic Degradable Carbon fraction (DOCf). With the amount of degraded organic matter decreasing, the potential for methane gas generation (Lo) also decreases as in equation (2).

    The amount of decrease in the amount of degraded organic material does not all disappear according to the amount of organic waste eaten by cows because cows excrete feces which provide additional degraded organic material. However, additional organic material degraded from cow dung is reduced. Cow activity occurs during the day between 07.00 - 17.00 WIB and then returns to the stable in and around the Jatibarang Landfill Area. Manure as long as the cow is in the drum does not add additional degraded organic material to the Garbage Dump cells that are utilized.

    In addition, the characteristics of organic waste and cowfeces are different, for example the speed of degradation and decomposition that affect the accumulation of methane gas generation. Cow feces are organic waste that has obtained natural "pre- treatment” in the cow’s stomach so that its speed can be different from organic waste, which according to the First Order Decay approach lasts more than a decade. Comparison of the speed of degradation of organic matter in livestock waste and organic waste needs to be further investigated to determine the effects of methane gas formation in the long run.

B. Incompatibility of garbage disposal with closed cells

    Closed landfill cells are in zones 1 and 2 covering 9 hectares of the total landfill area reaching 46 hectares. during the operation of the landfill throughout the year, disposal is not always in the planned zone. Displacement of disposal outside the planned zone occurs due to activities to repair landfill facilities, damage to leveling and compacting equipment, limited access, especially during the rainy season and landfill assessment. Adipura's assessment activity can divert garbage disposal to cells or other zones because it requires a good image of the zone used so that a high Garbage Dump value in Adipura assessment. The landfill manager diverts some of the garbage to be disposed of in another zone so that the cows move to follow the new waste so that the assessed zone can be arranged properly.

    The transfer process of waste disposal takes place in accordance with the duration of each disturbance. Disruptions occur every year so the diversion of disposal occurs every year. This reduces the weight of the garbage stored in the landfill cells that are used for electricity conversion even though it does not change the amount of waste dumped into the landfill. With the weight of stored waste (W) decreasing, the amount of Degraded Organic Material (DDOCm) decreases resulting in the potential for methane gas generation (Lo) to decrease.

C. Incorrect recording of the weight of the garbage

    Recording weight of the garbage can be different from the garbage dumped at the landfill. This is because the weighing equipment has not been installed since the landfill was operational so that the recording in the initial operational period of the landfill is carried out by the conversion of the vehicle transport volume and the number of vehicles entering the landfill. This conversion also follows the amount of the fuel budget that is in the APBD.

IV. CONCLUSION

1. Utilizing landfill gas into electricity is an alternative to utilizing energy as well as mitigating GHG emissions.

2. To achieve optimal benefits, estimating the amount of GHG emissions needs to pay attention to landfill management practices from operation until the closure of the landfill for the extraction and conversion of landfill gas into electricity.

3. The reduction in landfill gas can occur by landfill management practices that cause heavy waste dumped (W), Degraded Organic Carbon (DOC), Degraded Organic Carbon fraction which can be decomposed (DOCf) and Methane Correction Factor (MCF) which is not appropriate, thus affecting the Amount of Organic Material Degraded (DDOCm) and Potential Methane Gas (Lo).

4. The practice of letting cattle or other livestock in a landfill location can reduce organic waste. Although cow dung provides additional organic material, it can affect the generation of methane gas due to cattle grazing patterns (time in drums and landfills) and the different characteristics of the decomposition process.

5. The author suggests further research on the differences in the process of decomposition of organic waste and animal manure on the potential for long-term methane gas generation.
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Family-work conflict and safety performance: An unexamined relationship in the Ghanaian mining industry

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Abstract
Purpose – Studies on family-work conflict and job performance have received much attention. However, there are still unanswered questions about how family-work conflict affects specific job performance, such as safety performance. Therefore, this current study attempted to investigate the extent to which family-work conflict affects two kinds of safety performance, such as safety compliance and safety participation through the mediating role of job stress.

Design/methodology/approach – We developed a model that examined family-work conflict as the independent variable, job stress as a mediator variable, and safety compliance and safety participation of safety performance as the dependent variables. Using a questionnaire survey, we gathered 302 valid responses from contract mineworkers in Tarkwa, Ghana. We analysed the hypothesised relationships using the structural equation model.

Findings – From the results of our study, family-work conflict had a significant negative and positive effect on safety compliance and safety participation, respectively. Job stress also had a significant negative influence on safety compliance and safety participation. Furthermore, testing job stress as a mediator revealed that job stress could act as a partial mediator in the relationship between family-work conflict and all two dimensions of safety performance.

Originality/value – This current study is vital for managerial practices. Also, the structural model presents a different perspective on the impact of family-work conflict on safety-related issues.

Index Terms – family-work conflict; job stress; safety compliance; safety participation

I. INTRODUCTION

Family-work conflict describes the conditions when the demands of one’s family and work domains are mutually incompatible, and due to that work participation becomes challenging by participation in family role (Greenhaus & Beutell, 1985; Weer & Greenhaus, 2014). Family-work conflict is vital for both the employer and the employee because it is associated with negative consequences. The family-work conflict tends to cause high occupational burnout, increased job stress, poor safety performance etc. Despite the negative impact family-work conflict can cause, very few studies have considered how it influences safety performance (Cullen & Hammer, 2007; Smith, Hughes, DeJoy, & Dyal, 2018). Considering the mining operations where employees spend a lot of time and tortuous effort to get things done, the family-work conflict will be a severe issue to battle. According to KowalsKi-traKofler, Vaught, McWilliams, and Reisman (2011), the greatest challenge of coal mineworkers is their inability to balance their family demands with that of their job demands. This condition increased workers’ stress level and affected their performance as well; hence, they could not meet their company’s target (KowalsKi-traKofler et al., 2011). In the case of Ghana, where contract miners have a huge burden to achieve the high target to remain in the good books of the mother companies, it is anticipated that family-work conflict among contract workers will be worse. Upon all this, we could not find any published studies on family-work conflict and safety performance in the context of the Ghanaian mining industry. This current study will therefore seek to investigate the predictive nature of family-work conflict on safety performance among contract mineworkers and also examine the mediating role of job stress in the relationship between family-work conflict safety performance of contract mineworkers in Tarkwa-Ghana (see Figure 1).

Figure 1 A conceptual framework illustrating the relationships among family-work conflict, job stress and safety performance

Family-work conflict is classified as a workplace hazard, and it has a significant impact on employee performance (Karatepe & Sokmen, 2006; Netemeyer, Maxham, & Pullig, 2005; Smith & DeJoy, 2012). Also, some previous studies have suggested a negative relationship to exist between family-work conflict and safety performance (Cullen & Hammer, 2007; Turner, Herschovis, Reich, & Totterdell, 2014; Wu et al., 2018). Most mineworkers work more hours in a week and often have little time to spare with family members. Unfavourable work schedules can make some family members perceive that such
employees are shirking away from their responsibilities such as helping the kids with their homework, attending family gatherings, taking the kids out to play etc. This condition can also create inter-family conflicts and compel family members to interfere with the work of the employees (KowalsKi-traKofler et al., 2011). Anytime an imbalance occurs between one’s family and his or her work, performance is it that suffers. As family-work conflict increases, so shall safety performance deteriorate due to malicious work behaviour (Johnson, Eatough, Hammer, & Truxillio, 2019; Smith et al., 2018). Therefore, this study hypothesises that:

H1: Family-work conflict is a crucial predictor of safety performance.
H1a: Family-work conflict has a significant influence on safety compliance.
H1b: Family-work conflict has a significant influence on safety participation.

For mineworkers, the time and effort they spend at work are often more than what they spend with their family (Hongxia, Yongbin, Shuicheng, Fen, & Huan, 2014). This situation can result in insurmountable pressure for the workers and increase their stress level. Hongxia et al. (2014) also highlighted that workers whose family affairs interfere more with their work exhibited poor safety performance. As employees fail to balance their work activities with their family activities, so will their stress level continue to increase (Turner et al., 2014). In the work of Wu et al. (2018), they found a significant negative relationship to exist between family-work conflict. They concluded in their study that employees who have little ability to balance their family demands with that of their work demands performed low in the aspect of safety compliance and safety participation. From this background, this study hypothesises that:

H2: Family-work conflict is significantly related to job stress.
H3: Job stress has a significant relationship with safety performance.
H3a: Job stress has a significant influence on safety compliance.
H3b: Job stress has a significant influence on safety participation.

The family-work conflict has been suggested to have a critical impact on employees’ work performance, especially safety performance. However, they do so by inducing individual employees to be stressed up. Family-work conflict is a component of stressors (Cooper & Marshall, 1978; Netemeyer, Boles, & McMurrain, 1996; Wu et al., 2018). Job stress has been suggested to play a significant mediating role in the relationship between stressors and safety performance. Since family-work conflict is a component of stressors, and it can influence job stress, and job stress, in turn, can influence safety performance, it can be hypothesised that:

H4: Job stress will play a significant mediating role in the relationship between family-work conflict and safety performance.
H4a: Job stress will play a significant mediating role in the relationship between family-work conflict and safety compliance.
H4b: Job stress will play a significant mediating role in the relationship between family-work conflict and safety participation.

2. Methods

2.1. Population and Sample

Ghana is a country of several natural resources. Most of Ghana’s natural resources are located in its Western region and Tarkwa, a famous city in Western is known for its gold reserve. Three prominent mining companies are operating in Tarkwa (thus, two gold mining companies and one manganese mining company). These well-known mining companies are often referred to as mother companies because aside from their employees, some other aspects of their operations are done by different companies. The contractors and sub-contractors are often under pressure to achieve a high target to impress the mother companies. Employees of these contractors are often expected to manage work pressure as well as family pressure and perform well at the same time. Therefore, this study was conducted for only employees of mine-contractors operating in the mines in Tarkwa. Questionnaires were distributed to 405 contract mineworkers after authorisation had been sought from employees’ managers, union leaders and employees themselves. The questionnaires contained questions about demographics (e.g. gender, age, marital status, educational level and years of working experience), family-work conflict, job stress and safety performance. The respondents were given education about the essence of the study and assured that there were no wrong or right answer to any question. They were requested to provide an honest response to the questions. The respondents were also assured of full anonymity and confidentiality of their responses. The researchers personally collected 377 questionnaires from the respondents out of which 302 responses were filled and were valid.

2.2. Survey Instruments

2.2.1 Family-work conflict scale

The family-work conflict scale was developed by Netemeyer et al. (1996) through extensive literature review and collecting responses from 182 elementary and high school teachers and administrators. In this present study, the family-work conflict scale was adopted to measure the kind of stressful event employees could perceive and the extent of conflict that affected employees’ safety performance in the extractive sector. The scale contained five items, and it was measured with a 5-point (1–5) Likert scale ranging from 1 = strongly disagree, 2 = agree, 3 = not sure, 4 = agree to 5 = strongly agree. Since the family-work conflict scale was being used for the first time in a study of this kind, it was essential to establish its psychometric properties before being used in the final survey. The scale was first piloted on forty-three employees, and its reliability was 0.76. It was re-tested on additional 65 employees, and its Cronbach alpha was 0.86, indicating excellent reliability. We, therefore, accepted to employ the scale for the final survey analysis. All respondents chosen for the pilot and re-pilot studies were excluded from the final survey analysis.

2.2.2 Perceived Stress Scale (PSS)

The 10-item perceived stress scale (PSS) developed by Cohen, Kamarck, and Mermelstein (1983). It has received a lot of recognition in areas such as education (Reis, Hino, & Rodriguez-Añez, 2010), police service (Wang et al., 2011), the health sector (Mimura & Griffiths, 2004) etc. but less recognition in the
mining industry most especially Ghanaian mining industry. Therefore, this present study adopted the PSS to assess the level of job stress perceived by employees in the Ghanaian mining sector. Before finally accepting to use the PSS, we first performed a pilot study using forty-three employees and checked the reliability of the scale. The Cronbach alpha for the piloted scale was 0.80. We again re-piloted the scale using different 65 employees and Cronbach alpha recorded was 0.82 indicating very good reliability. Therefore, we accepted to employ the scale for the final survey analysis. All respondents chosen for the pilot and re-pilot studies were excluded from the final survey analysis.

2.2.3 Safety Performance
The safety performance construct was measured with ten items from the safety performance scale developed by DeArmond, Smith, Wilson, Chen, and Cigularov (2011). Four out of the ten items measured safety compliance and the remaining six items measured safety participation behaviour of employees.

2.2.4 Control Variables
Five demographics were gathered and added during hypotheses testing to control for confounding effects. The controls were gender, age, marital status, educational level and working experience. These controls might influence safety performance and have been widely used safety literature (Guo, Yiu, & Gonzalez, 2018; Ye, Ren, Li, & Wang, 2020).

3. Data Analysis
This study used both SPSS version 26 and AMOS version 26 for the data analysis. The SPSS was used to perform the preliminary such as the exploratory factor analysis. Structural equation model (SEM) with AMOS 26 was used to assess the data about the effects of family-work conflict, job stress and employee-work experience on safety performance.

4. Results
4.1 Demographic characteristics
Results from the data showed that 156 (51.7%) out of the 302 responses were male respondents, and 146 (48.3%) respondents were females. The ages of the respondents from 20 – 30 were 28 (9.27%), 31 – 40 were 110 (36.42%), 41 – 50 were 151 (50%) and 13 (4.31%) respondents were above 50 years. Regarding the marital status of the respondents, there were 156 (51.7%) respondents who were married, 78 (25.8%) were never married, 55 (18.2) had married before but divorced, and 13 (4.3%) were either widows or widowers. Concerning the educational level of the participants, 131 (43.4%) of them had either bachelor or higher national diploma certificate, 165 (53.6%) had senior high school certificate, and 6 (2.0%) had a junior high school certificate. Finally, the demographics are the years of working experience of the respondents. 6 (2.0%) of the respondents had less than 1-year working experience, 16 (5.3%) had working experience from 1 to 5 years, 62 (20.5%) had from 6 to 10 years working experience, and 218 (72.2%) had more than ten years working experience.

4.2 Reliability, validity and inter-factor correlation analysis
Table 1 shows the factors loadings of both exploratory and confirmatory factor analyses, average variance extracted, composite reliability and Cronbach alpha values. This study performed two kinds of factor analyses to check the reliability and validity of the scales chosen. They included exploratory and confirmatory factor analyses. The exploratory factor analysis revealed that all the items appropriately loaded under their predicted factors. The Kaiser-Meyer-Olkin Measure (KMO) of Sampling Adequacy for all the four scales was 0.894, and it was significant at 0.001. The four scales had a total eigenvalue of 14.359 that accounted for 57.437% of the total variances explained. The study also performed a common bias test by setting the number of factors to be extracted to one (1) using SPSS. The outcome revealed that only 28.72% of the total variance could be explained by just one factor. Since the variance explained by one factor was less than 50%, it will not be erroneous to suggest that our data did suffer from common method biases.

The study performed further analysis to establish additional support for the data. Therefore, confirmatory factor analysis was performed using AMOS version 26.0 software. Except for one item belonging to the safety compliance scale, which recorded a standardised factor loading of 0.496 and was significant, all other item had a standardised factor loading greater than 0.50. The measurement fit indices for the measurement model (see Figure 2) revealed a Chi-square ( \( \chi^2 \) = 405.122, degree of freedom (df) = 269, normed Chi-square ratio (\( \chi^2/df \)) = 1.506, standardized root mean square residual (SRMR) = 0.050, root mean square error of approximation (RMSEA) =0.041, PClose =0.969, comparative fit index (CFI) =0.959, Tucker-Lewis fit index TLI = 0.954 and they fit the data well. The Cronbach alphas and composite reliabilities for the factors were either 0.75 or more indicating good internal consistencies. Except for the average variance extracted (AVE) for the safety participation, which was 0.582, any other factor in the study had an AVE less than the 0.50 threshold. According to Malhotra and Dash (2011), AVE is too concerning establishing reliability through composite reliability alone is acceptable. The discriminant validity values from the square the root of the AVE for family-work conflict, job stress, safety compliance and safety participation were also greater than the associated latent variables correlations (see Table 2).

| Table 1 Validity and reliability of the scales |
|--------------------------|----------|----------|----------|----------|----------|
| Variable | Item code | CFA β | EFA β | AVE | CR | Cronbach Alpha (α) |
|--------------------------|----------|----------|----------|----------|----------|
| Family-work conflict (FWC) | FWC2 | .697 | .757 | 0.462 | 0.811 | .811 |
| FWC1 | .667 | .756 | | | | |
| FWC5 | .716 | .708 | | | | |
| FWC4 | .655 | .705 | | | | |
| FWC3 | .661 | .657 | | | | |
| Job stress (JS) | JS10 | .675 | .758 | 0.452 | 0.891 | .890 |
| JS3 | .728 | .701 | | | | |
| JS2 | .713 | .689 | | | | |
| JS4 | .683 | .687 | | | | |
| JS5 | .639 | .672 | | | | |

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Table 2 Inter-factor correlation matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Family-work conflict</td>
<td>0.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Job stress</td>
<td>0.445***</td>
<td>0.672</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Safety compliance</td>
<td>-0.337***</td>
<td>-0.352***</td>
<td>0.677</td>
<td></td>
</tr>
<tr>
<td>4. Safety participation</td>
<td>0.184**</td>
<td>-0.548***</td>
<td>0.013</td>
<td>0.763</td>
</tr>
</tbody>
</table>

Note: ** p < 0.01, *** p < 0.001, values in bold represent discriminant validity

Figure 2. Measurement model

4.2 Hypotheses testing

In testing the hypotheses, the study began by assessing the effect of family-work conflict on safety performance (Hypothesis H1). A structural model was estimated in Amos version 26 software (Figure 2). The model gave good fit with the data ($X^2 = 189.563$, $df = 148$, $X^2/df = 1.281$, $CFI = 0.98$, $SRMR = 0.042$, $TLI = 0.974$, $RMSEA = 0.031$). The standardized coefficients values from family-work conflict to safety compliance and safety participation were $-0.33$ ($p < 0.001$, $t = -4.286$) and $0.178$ ($p < 0.01$, $t = 2.643$) respectively, providing support for H1 (H1a and H1b).

The study then tested the full structural mediation model (see Figure 4), where job stress was included in the main effect model (Figure 3). This method of testing the mediation is consistent with extant literature (Madrid, Diaz, Leka, Leiva, & Barros, 2018; Ye et al., 2020).

As it has been shown in Figure 4, the structural mediation model had a good fit with the data ($X^2 = 518.983$, $df = 375$, $X^2/df = 1.384$, $CFI = 0.959$, $TLI = 0.953$, $SRMR = 0.046$, $RMSEA = 0.036$). The standardized path coefficient from family-work conflict to job stress was $0.452$ ($p < 0.001$; $t = 5.822$), providing support for H2. Concerning the effect of job stress on safety compliance and safety participation, the standardized coefficients of the paths were $-0.218$ ($p < 0.01$; $t = -2.84$) and $-0.796$ ($p < 0.001$; $t = -7.978$) respectively, providing support for H3 (H3a and H3b).

In Table 3 are the results for the direct, indirect and total effect. The indirect effect of family-work conflict on safety compliance and safety participation through job stress recorded standardized estimates of $-0.099$ with 95% confidence intervals of $[-0.184, -0.025]$ and $-0.36$ with 95% confidence intervals of $[-0.502, -0.228]$ respectively. Thus, it provides support for H4 (H4a and H4b).

Table 3. Analysis of the direct, indirect and total effect

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Safety compliance</th>
<th>Safety participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct effects</td>
<td>$\beta$</td>
<td>$\beta$</td>
</tr>
<tr>
<td>Family-work conflict</td>
<td>$-0.251**$</td>
<td>0.547***</td>
</tr>
<tr>
<td>Job stress</td>
<td>$-0.218**$</td>
<td>$-0.796***$</td>
</tr>
<tr>
<td>Indirect effect</td>
<td>$\beta$ (95%CI)</td>
<td>$\beta$ (95%CI)</td>
</tr>
<tr>
<td>FWC $\rightarrow$ JS $\rightarrow$ SC</td>
<td>$-0.099$ ($-0.184, -0.025$)</td>
<td>$-0.36$ ($-0.502, -0.228$)</td>
</tr>
<tr>
<td>FWC $\rightarrow$ JS $\rightarrow$ SaP</td>
<td>$-0.099$ ($-0.184, -0.025$)</td>
<td>$-0.36$ ($-0.502, -0.228$)</td>
</tr>
<tr>
<td>Total effects of family-work conflict</td>
<td>$-0.349***$</td>
<td>$-0.186**$</td>
</tr>
</tbody>
</table>

Note: ** p < 0.01; *** p < 0.001, 95%CI based on 5,000 bootstrapping.

Abbreviations: FWC = family-work conflict; JS = job stress; SC = safety compliance, SaP = safety participation
between family-work conflict and safety performance. The findings of this study, however, provides support for findings in the work of Cullen and Hammer (2007). When employees often encounter demands from their families that conflict with their work, employees’ behaviours are likely to be affected (Frone, Russell, & Cooper, 1992). Employees who experience higher family-work conflict may have troubles focusing on the best safety approaches for executing roles. Such employees may decrease safety behaviours, such as safety compliance than employees who experience lesser family-work conflicts (Cullen & Hammer, 2007). The positive significant impact family-work conflict had on safety participation could be because some employees who do not have the peace of mind at may prefer to spend more hours at the workplace. Such employees may choose to engage in several extra work activities (e.g. safety participation) that will take much of their daily 24 hours, thereby spending fewer hours with their family.

Findings from the results of the study also demonstrated that family-work conflict has a significant positive influence on job stress providing support for findings in some similar studies like Turner et al. (2014) and Hongxia et al. (2014). As family-work conflict increases so will job stress among contract workers increase. Job stress also exhibited a significant negative influence on safety compliance and safety participation thereby confirming findings in some similar previous studies like Khuong and Yen (2016) and Mimura and Griffiths (2003) even though our study considered a more specific aspect of performance. Employees who encounter more job stress may suffer from physical stress (e.g. headache, lower backache and insomnia) of psychological stress (e.g. nervousness, anger, sadness and fear). These symptoms may cause the health of the employee to deteriorate and consequently affect their general performance including safety performance (Leung, Liang, & Olomolaiye, 2016; Zhu, Quansah, Obeng, & Cobbinah, 2020).

Concerning findings from results, job stress had a partial mediation effect in the relationship between family-work conflict and the factors of safety performance. This outcome is in line with similar studies (e.g. Leung, Chan, and Yu (2012), Abbe, Harvey, Ikuma, and Aghazadeh (2011), Khuong and Yen (2016) etc.) that have suggested that job stress has a mediating ability in the relationships between antecedents of stress and employee performance.

Besides the findings of this present study, both theoretical and practical contributions have also been made. Theoretically, this study has demonstrated that family-work conflict has both a direct and indirect effect on safety compliance and safety participation through the mediating role of job stress. Practically, the negative and positive impact of family-work conflict on safety compliance and safety participation respectively will have serious managerial implications. As employees continue to experience more stress, their desire, and concentration to practice safety participation diminish. Lower compliance to safety standards will result in higher injuries and even fatal accidents (Leung et al., 2016; Siu, Phillips, & Leung, 2004; Stemn, Bofinger, Cliff, & Hassall, 2019).

Furthermore, organisations exist to provide economic relief and other life security. Organisations do exist to dismantle or create broken homes. Organisations must have systems in place to
quickly identify employees whose family issues due to their work and help solve them immediately.

6. Limitations and suggestions for future studies

Though the outcomes of the study extend and improve previous literature, it is advisable to appreciate some possible limitations. First, the study used self-response data. Using self-reporting data has a high possibility of generating common method biases. To reduce the possibility of common method biases, the researchers assured the respondents of maximum anonymity. Items such as name and worker’s code were eliminated from the questionnaire. The respondents were told that there were no right or wrong answers and that they should respond to the questions with all honesty. This method reduces one’s evaluation apprehension, making them less possibly to edit their answers to be more socially desirable, lenient, acquiescent and consistent with their perception about the expectations from the researcher (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Results of the common method bias test show that the study did not have any issues of common method biases since none of the factors could explain more than 50% of the variance. Second, the study only considered one antecedent of stress to influence safety performance. There are several other antecedents of stress this study could have included in the survey analysis. Future studies should consider more antecedents of stress such as factors intrinsic to the job aspect, organisational style and interpersonal relationships to ascertain more appropriate information on how different stressors affect different safety performance in a single model. Additionally, the study considered only contract miners in Tarkwa, which makes generalising of the findings inappropriate. The researchers will consider a broader scope by including miners in other parts of Ghana and workers from different fields such as construction, education, health etc.

<table>
<thead>
<tr>
<th>Questionnaire</th>
<th>Item / question /statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family-work conflict (FWC)</td>
<td>The demands of my family or spouse/partner interfere with work-related activities</td>
</tr>
<tr>
<td>FWC2</td>
<td>I have to put off doing things at work because of demands on my time at home.</td>
</tr>
<tr>
<td>FWC3</td>
<td>Things I want to do at work don’t get done because of the demands of my family or spouse/partner.</td>
</tr>
<tr>
<td>FWC4</td>
<td>My home life interferes with my responsibilities at work, such as getting to work on time, accomplishing daily tasks, and working overtime.</td>
</tr>
<tr>
<td>FWC5</td>
<td>Family-related strain interferes with my ability to perform job-related duties.</td>
</tr>
<tr>
<td>Job stress (JS)</td>
<td>In the last month, how often have you been upset because of something that happened unexpectedly?</td>
</tr>
<tr>
<td>JS2</td>
<td>In the last month, how often have you been angered because of things that happened unexpectedly?</td>
</tr>
<tr>
<td>JS3</td>
<td>In the last month, how often have you felt nervous and ‘stressed’?</td>
</tr>
<tr>
<td>JS4</td>
<td>In the last month, how often have you been unable to control the important things in your life</td>
</tr>
<tr>
<td>JS5</td>
<td>In the last month, how often have you felt that things were going your way?</td>
</tr>
<tr>
<td>JS6</td>
<td>In the last month, how often have you found that you could not cope with all the things that you had to do?</td>
</tr>
<tr>
<td>JS7</td>
<td>In the last month, how often have you been able to control irritations in your life?</td>
</tr>
<tr>
<td>JS8</td>
<td>In the last month, how often have you felt that you were on top of things?</td>
</tr>
<tr>
<td>JS9</td>
<td>In the last month, how often have you been angered because of things that were outside of your control?</td>
</tr>
<tr>
<td>JS10</td>
<td>In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety compliance (SC)</th>
<th>SC1</th>
<th>I minimise exposure to hazards by using the appropriate work practices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SC2</td>
<td>I use the correct personal protective equipment as indicated by the mine’s health and safety plan</td>
</tr>
<tr>
<td></td>
<td>SC3</td>
<td>I use the right steps if denied from or penalised for exercising my rights under OSHA policies and procedures</td>
</tr>
<tr>
<td></td>
<td>SC4</td>
<td>I appropriately report injuries, accidents, or illnesses to my superiors</td>
</tr>
<tr>
<td>Safety participation (SaP)</td>
<td>SaP1</td>
<td>I help others to ensure they do their work safely</td>
</tr>
<tr>
<td></td>
<td>SaP2</td>
<td>I explain to others why I will report safety violations</td>
</tr>
<tr>
<td></td>
<td>SaP3</td>
<td>I try to change the way the job is done to make it safer</td>
</tr>
<tr>
<td></td>
<td>SaP4</td>
<td>I voice out and encourage others to get involved in safety issues</td>
</tr>
<tr>
<td></td>
<td>SaP5</td>
<td>I take actions to prevent safety violations in order to protect the well-being of other crew members</td>
</tr>
<tr>
<td></td>
<td>SaP6</td>
<td>I attend non-mandatory safety-oriented training</td>
</tr>
</tbody>
</table>

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Effectiveness Of Energy Sector Quality Management Systems In Response To Electrical Fire Disaster In Kisumu County, Kenya

Hassero, C., Dr. Nabiswa, F. & Rev. Dr. Odhiambo, E. O. S.

Masinde Muliro University of Science and Technology, Kenya Department of Emergency Management Studies

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Abstract- Globally, utility power transmission and distribution systems are described along with their observed vulnerabilities to natural and man-made hazards. At national level, approximately 40% of the load in the Western region is supplied via 33/0.433 kV secondary distribution transformers. This contributes to transformer overload strain thus contributing to electrical fire disasters and outages. Kisumu substations are overloaded in the existing system under peak load conditions due to low thermal rating of conductors as a result of inadequate sizing. Several line sections feeding a large proportion of the load are of conductor type 25mm2 ASCR causing an effective bottleneck leading to power outages and electric fire disasters. Due to these, the study sought to assess the effectiveness of energy sectors quality management systems in response to electrical fire disaster in Kisumu County. Cross-functional management model and Crosby Theory of Quality theories guided the study. A descriptive research design was used in the study. Sample size of the study was selected using purposive, census and stratified random sampling from the energy sectors; Kenya Power and Lighting Company, Kenya Electricity Transmission Company, Kenya Energy Generating Company and customers connected to electricity grid. The structured questionnaires, interviews guides and observation methods were used to collect data. Quantitative data was analyzed using descriptive statistics while qualitative data responses using thermalized and frequencies. Organizations have not ensured ISO certification requirements in their management systems. That organizations quality management systems were less effective in relation to electric disasters response. The paper recommends that all organization should implement ISOcertification requirements on their management systems. Effect their systems through assistance from other organizations with the same role for effective electric disaster management.

Index Terms- Disaster Management Systems, Electric Disaster and Quality Management Systems

I. INTRODUCTION

Globally, utility power transmission and distribution systems are described along with their observed vulnerabilities to natural and man-made hazards. Considering the preparation for and effects of widespread electrical disasters, it is worthwhile reviewing recent major electricity outages. For instance, earthquakes, tsunamis, hurricanes and floods destroy transmission and distribution systems, including cables, towers and utility poles. Sioshansi (2011), argues that restoration of this infrastructure take very long periods of time.

Major pieces of infrastructure such as generators get flooded or roads blocked, limiting delivery of fuel supplies to local generators. Further, electrical equipment belonging to consumers can be swamped with water, posing the risk of electrocution, and therefore loss of lives (Krishnamurthy and Kwasinski, 2013). This means that power equipment must meet the required standards to ascertain qualities in considerations of type of hazard. The efficiency of the transmission and distribution network shows gap in both technical and non-technical terms. The technical aspect reveals lack re-conducting of lines, installation of capacitors, and construction of additional feeders and substations that withstand hazards and stabilize power distribution. On the other hand, non-technical revealed lack of introducing electronic meters, improvement of meter reading accuracy, fraud control and resolution of billing anomalies (Tan, et al., 1998).

Kisumu County is served by the 132 kV transmission system feeds 10 132/33 kV bulk supply points. The 33 kV network comprises 52 radial feeders, 71 primary substations and approximately 2000 33/0.433 kV distribution transformers. Approximately 40% of the load in the Kisumu County is supplied via 33/0.433 kV secondary distribution transformers. There are small generating stations at Gogo Falls and Eburu, which generate electricity from hydro and steam resources respectively (Greenwire et al., 2008).

However, transformers at Kisumu, Kegati 132/3 3 kV substations are overloaded in the existing system under peak load conditions. Further, voltage and loading issues are evident on the Kondele feeder supplied from Obote Road primary substation. This is due to low thermal rating of conductors as a result of inadequate sizing. Several line sections feeding a large proportion of the load are of conductor type 25mm2 ASCR causing an effective “bottleneck”. Sinei (2013), argued that planning guidelines provided by KPLC have not been applied during the extension of a spur from the main feeder. Some of the electric gadgets are not standard which causes outages. Further, manual recording, he argues, result in erratic values that may not represent the true load behavior.
The measurements at the substation transformers are seldom recorded. At peak hours, the load is high such that power is lost in some parts of this region. Sometimes, it takes long to restore power. The power supply doesn’t meet demand, and therefore, power fluctuations are norms. According to Greenwire et al. (2008), secondary transformers do not guarantee stable power supply, and therefore, power fluctuations would lead to electric disasters such as outages.

1.2 Statement of the problem
Power transmission and distribution systems are affected by vulnerabilities as a result of natural and human induced disasters. For instance, these disasters damages electrical facilities and thus affecting transmission and distribution systems (Krishnamurthy and Kwasinski, 2013).

Kenya Energy Sector organizations are making loses as a result of poor quality management systems, resulting to electric induced fires that lead to destruction of property and loss of lives (Vanya, 2015).

Kisumu County are known for heavy storms and strong winds. Power outages are common and electrical fire disasters related to the same are common. Approximately 40% of the load in the Kisumu region is supplied via 33/0.433 kV secondary distribution transformers. Secondary transformers do not guarantee stable power supply, and therefore, power fluctuations lead to electrical disasters as a result of outages (Greenwire et al., 2008).

The preparation, mitigation, response and recovery from electrical disasters at Kenya energy sector are determined with level of management systems the companies possess, which it is not addressed to forestall electric disasters (Sinei, 2013). It’s in view of this that the study evaluates the effectiveness of energy sector quality management systems in response to electrical fire disaster in Kisumu County.

1.3 Objective of the study
The objective of the study was to assess the effectiveness of energy sector quality management systems in response to electrical fire disaster in Kisumu County.

1.4 Research Question
How effective is the energy sector quality control system in relation to electrical fire disaster in Kisumu County?

1.5 Justification of the Study
From a research and academic perspective, previous studies have concentrated on issues of strategic management, Marnay et al., (2008) and change management in energy sectors (Sinei, 2013). Therefore, the study will assist both the state and private organization in various perspective.

1.5.1 Academic Justification
From academic perspective, the study by Njenga (2016) focused on quality management practices and performance of energy sector parastatals in Kenya, without giving attention to their influence to electrical fire disasters hence the gap. It is on this basis that the study went a notch higher to fill the identified gap thereby, investigating the influence of Kenya Energy Sector’s Quality Management Systems with regard to electrical fire disaster in Kisumu County.

The study will provides a foundation for further research in the field of disaster management. The findings of the study will improve the academics in electrical fire disaster response among organizations, and how energy organizations should adopt use of quality management systems in daily running in their functions and beyond by increasing reference materials in academic institutions to act as training manual for corporates.

1.5.2 Policy Justification
From a policy perspective, previous study by Sinei (2013), exploring management issues at energy sectors and how these management policies affect performance. This study have suggested policy change with regard to quality management systems such as design, planning and standards of electrical equipment that bring about electrical fire disasters as a result of natural or man-made hazards. Thus, policy makers in the energy sector would improve on quality of electric equipment, management of power lines and how to prepare, respond and recover from electric disasters.

II. 2.1 NATURE AND EXTENT OF QUALITY MANAGEMENT SYSTEMS WITH REGARD TO ELECTRICAL FIRE DISASTERS
The connection between utility power transmission and distribution systems and vulnerabilities to natural hazards or human induced is obvious. Natural hazards include winter storms (freezing rain, snow and ice), high-wind events (hurricanes, tornadoes, and nor’easters), flooding (riverine and coastal), storms and earthquakes. Each of these hazards presents a unique set of design challenges for electrical transmission and distribution power systems (Sioshanis, 2011).

Sioshanis further argues that considering the preparation for and effects of widespread electrical fire disasters, it is worthwhile reviewing recent major electricity outages. This electric disaster led to untold damage from natural disasters in recent years in many a nation. For instance, earthquakes destroy transmission and distribution systems, including cables, towers and utility poles. The restoration of this infrastructure and the services it provides take very long periods of time. Further, electrical equipment belonging to consumers can be drowned with water, posing the risk of electrocution, and therefore loss of lives.

Major electric outages do not just occur due to natural events such as earthquakes or storms. Moreover, relatively minor incidents such as a small fire or a single downed transmission line trigger events that can cause cascading failures and result in widespread electrical failure, as happened in Italy in 2003 and India in 2012. More importantly, as well as reviewing the impact of the major electrical disasters is should be done to improve the reliability and resilience of electricity supply (Su, et al., 2008).

Blyden and Lee (2006), concurs that the centralized nature of many power systems means that relatively small damage, in a few key areas, can lead to extensive power outages. These vulnerable areas were not identified prior to the disaster.

Electricity networks contain significant amounts of distributed generation, yet such generation cannot be relied upon to maintain electricity supply after a major electric disaster. In general, this is
an issue of planning and analysis within a power company. If this not the case, facilities and end-users face significant uncertainty in how to evaluate the risks of natural disasters, or their preparedness against such risks. Without any uniform way of measuring these risks, or preparedness for them, it is difficult for facilities to evaluate their own position, to prepare detailed disaster resilience or recovery plans, or compare one facility against another (Marnay et al., 2008).

According to Krishnamurthy and Kwasinski (2013), the key factors in minimizing the damage and costs associated with major electric outages is the quality of planning how well prepared an organization was to avoid loss of electricity supply after a major disaster, and, quite separately, how well the recovery from a major electric outage was planned.

From this review, planning needs to have continuity which is a key requirement for any successful business and coping with major outages whether from communication infrastructure failures or cyber-attacks is a critical task for organizations such as data centers. Thus, standardization of activities that provide guidelines and codes of practice for planning against major interruptions in many power companies is quite important. The following sub-section looks at how electric disasters relate directly to QMS of Kenya Power and Lighting Company.

Given the complexity of electricity systems and the growing popularity of distributed generation and related energy technologies in customer’s premises, a new continuity plan specifically focused on electricity supply resilience and restoration is needed in many organizations. So-called ECP will specifically consider how to rapidly restore electricity supply to a particular site, based either on outside supply or internal provision (Marnay et al., 2008). Thus, preparedness against disaster will never be perfect without appropriate operational strategies. Installation of a back-up system or micro grids reinforce the preparedness against disaster.

In contrast to BCP, unique electrical issues that should be considered by an ECP include: Alternative generation sources, the use of local back-up generation; dependencies outside the electrical equipment that may affect electricity supply for example, the availability of fuel for back-up generators and identification of particular electrical loads, their priority for business functions, and their energy requirements (Heavey et al., 2014).

Blyden and Lee (2006), noted that electrical fire disasters impact depends on the country, geography and infrastructure. Thus, the ECP metrics need to be carefully selected and assessed in terms of the insight they offer regarding the likely impact on electricity supply. The ultimate aim to standardize the way of measuring and comparing potential natural disasters is critical.

Krishnamurthy and Kwasinski (2013), argues that once an understanding of likely disasters and their severity has been established, a facility can then start to evaluate to what extent it is prepared against each disaster. The goal is to design a standard set of metrics that can indicate a facility’s preparedness against disaster and loss of energy supply, effectively allowing the level of preparedness of each facility to be compared to one another.

There is currently no standard method to specify a load’s electricity supply requirements. Such classifications may be based on individual pieces of equipment, where classes of load are introduced based on metrics such as: Acceptable supply interruption duration; acceptable supply frequency range and acceptable supply voltage range (Basir et al., 2011).

2.2 The Electricity Continuity Systems and Disaster Response

To stabilize power supply and minimize electrical disasters, backup systems are critical. By best practice, renewable energies (that is photovoltaic and batteries) are effective for maintaining energy during disasters (Sioshansi, 2011). In this specific case, it was only after the incident that consumers recognized the fact that distributed generations, such as photovoltaic generations and CHP systems that are installed to realize carbon dioxide (CO2) zero emission houses are successful in quickly recovering electricity supply in the case of disasters.

ECS detects loss of power from the grid by delinking function for grid and micro grid; power supply and monitoring functions from batteries to micro grid; checking function for safety inside micro grid; communication tool to check safety of connected appliances before recovery from blackout and minimizing power loss and saving conversion loss by DC power. Secondly, using renewable energies ensure penetration ratio (efficient utilization), capacity of batteries (Gravin et al., 2017).

2.3 Kenya Energy Sector’s Quality Management Systems in regard to electrical fire disasters in Kisumu County

Electrical fire disasters in form of economic losses affect both KPLC and customers. KPLC, designs associated with construction or rehabilitation contributes to economic losses. For example, the sizing conductors and transformers in the energy sector not only minimize losses to an economic level, but also implements not the lowest construction cost solution, but the lowest lifetime cost solution. Generally, losses will be maintained at acceptable levels if planning guidelines are followed and network parameters are maintained within the planning limits. This means keeping: Voltage within required range; Equipment loaded to standard levels; and Power factor at optimal levels (Rossi et al., 1999).

Sinei (2013), argues that the most cost effective way to reduce losses at the distribution level is to ensure that maintenance and construction problems are corrected. She argues that poor jointing practice and materials add unnecessary losses to feeders, and can often lead to line failures and therefore electric disasters.

That developments to respond to outages and on-going maintenance, is generally not fixed on a permanent basis. Kenya Power and Lighting Company report indicate that the bus couplers on the 33 kV and 11 kV busbars are operated open at Sibembe and Obote Road primary substations.

With such planning, however, transformers at Kisumu and Kegati 132/33 kV substations are overloaded in the existing system under peak load conditions. Voltage and loading issues are
evident on the Kondele feeder supplied from Obote Road primary substation. This is due to low thermal rating of conductors as a result of inadequate sizing. Several line sections feeding a large proportion of the load are of conductor type 25mm$^2$ ASCR causing an effective “bottleneck”. Evaluation suggests that the planning guidelines provided by KPLC have not been applied during the extension of a spur from the main feeder (Otuki, 2017).

2.4 Conceptual Framework

2.4.1 Cross-functional management model

Juran cross-functional management approach comprises three legislative processes:

Quality Planning: a process that involves creating awareness of the necessity to improve, setting certain goals and planning ways to reach those goals. This process has its roots in the management's commitment to planned change that requires trained and qualified staff.

Quality Control: a process to develop the methods to test the products for their quality. Deviation from the standard will require change and improvement.

Quality Improvement: a process that involves the constant drive to perfection.

According to Juran (1992), Quality improvements need to be continuously introduced. Problems must be diagnosed to the root causes to develop solutions. The Management must analyze the processes and the systems and report back with recognition and praise when things are done right.

2.4.2 Crosby Theory of Quality

Crosby's principle, Doing It Right the First Time, was his answer to the quality crisis. He defined quality as full and perfect conformance to the customers' requirements. The essence of his philosophy is expressed in the Absolutes of Quality Management and the Basic Elements of Improvement (Creech, 1994).

2.4.2.1 Zero Defects

Crosby's Zero Defects is a performance method and standard that states that people should commit themselves too closely monitoring details and avoid errors. By doing this, they move closer to the zero defects goal. According to Crosby, zero defects was not just a manufacturing principle but was an all-pervading philosophy that ought to influence every decision that we make especially energy sectors. Managerial notions of defects being unacceptable and everyone doing ‘things right the first time’ are reinforced (Crosby, 2012).

2.4.2.2 The Quality Vaccine

Crosby explained that this vaccination was the medicine for organizations to prevent poor quality.

Integrity: Quality must be taken seriously throughout the entire organization, from the highest levels to the lowest. The company’s future will be judged by the quality it delivers.

Systems: The right measures and systems are necessary for quality costs, performance, education, improvement, review, and customer satisfaction.

Communication: It is required to communicate the specifications, requirements and improvement opportunities of the organization. Listening to customers and operatives intently and incorporating feedback will give the organization an edge over the competition.

Operations: a culture of improvement should be the norm in any organization, and the process should be solid.

Policies: policies that are implemented should be consistent and clear throughout the organization. Figure 2 showing the interaction of the variables.
III. RESEARCH METHODOLOGY

3.1 Research Design

The study was qualitative in approach; with a single overall objective aimed to examine the effectiveness of energy sector quality management systems in response to electrical fire disaster in Kisumu County. Descriptive survey design was conducted in the selected areas of Kisumu County considered appropriate to enhance an apt determination of the state of quality management systems and their effectiveness in response to electric fire disasters.

3.2 Sample Size Determination and Sampling Procedure

A sample size of one hundred and sixty respondents drawn from energy sectors and customers connected to electricity grid clusters was used in the study. The sample size was drawn from the target population of 1865 by use of purposive sampling in which (30%) technique applied in selection of respondents from the identified five organizations; KEBS, Energy Regulatory Commission, KENGEN, KPLC and KETRACO. Customers connected to the electricity grid also formed part of the sample size.

3.3 Data Collection Methods

Both primary and secondary data collection was used to collect the relevant information. Primary data was collected from the field through structured questionnaires, interviews guides’, observation checklist, focused group discussion and document analysis. The use of several data collection methods was enable the researcher to avoid the deficiency that springs from using one method of data collection method (Kothari, 2004). Secondary data was collected by analysis of publications such as electrical fire disaster journals, electricity/energy related legislations and government documents.

3.4 Data Analysis

The collected data was cleaned by listing, removed errors and checked extreme values and edited to ensure conformity. The group survey data was analyzed using SPSS Version 27. The variables were subjected to descriptive statistics. Quantitative data was analyzed using descriptive statistics such as frequencies and percentages. Findings were presented in form of frequency tables, pie charts, bar graphs and narratives.

IV. RESULTS

4.1 Organization ISO certification requirements on management systems

![Figure 2: Conceptual framework model showing variables interactions](source: Researchers (2019))
4.2 Effectiveness of organizations systems in relation to electric disasters quality management service provision

ISO 9001:2015 is the most recognized and implemented quality management system standard in the world. ISO 9001:2015 specifies the requirements for a QMS that organizations can use to develop their own programs (Dennis, 2007). Each element of a quality management system helps achieve the overall goals of meeting the customers’ and organization’s requirements including the organization’s quality policy and quality objectives. Figure 5.4 shows the response on effectiveness of organizations systems in relation to electric disasters quality management service provision.

Out of 160 respondents, 19 (12%) of the respondents from customers connected to the electricity grid were excluded because of the nature of the data that the respondents were asked to give. Therefore, the response rate was 141 (88%). 11 (7%) of the respondents had views that their organization had very effective systems in relation to electric disasters quality management service provision. Supported by 53 (33%) of the respondents under effective opinion. 61 (38%) of the respondents claimed that their organizations systems in relation to electric disasters quality management service provision were less effective. 10 (6%) were of the opinion that it had no association while 6 (4%) of the respondents were not sure if their organizations systems in relation

Figure 3: Organization ISO certification requirements in management systems

Source: Field Data Analysis (2019)

Data analysis showed that 85 (54%) of the respondents under “YES” response agreed that their organizations ensured ISO certification requirements in their management systems while 56 (34%) of the respondents were under “NO” response, implying that their organizations had not ensured ISO certification requirements in their management systems. The threshold between the respondents who were of the opinion under yes response and no response was 20%, indicating that even if other organizations have it, they have not yet realized its vital role in quality management. The response rate is in exclusion of the customers connected to the electricity grid since they were not part of energy organizations.

Basing on the findings, the fact that the Anti-Counterfeit Agency had put contraband electrical cable importers on a notice warning of stringent penalties showed that the respondent’s response on yes opinion was because of preserving reputation of their firm, thereby research finding contradicting relied information by Gravin et al (2017), that anti-Counterfeit Agency (ACA) claimed that illegal sub-standard electrical cables importation posed great harm to Kenyans. The case of containers impounded in a Mombasa Freight station containing over 2,000 electrical cables purportedly destined for the South Sudan market thus sparking the need for inter-agency efforts to reinforce arrangements for pre-shipment inspection of products coming into the country.

Commercial wooden pole treatment plants; Kakuzi, Gilgil Telecommunications E A Cabro Industries, Timsales Ltd, Typsy Timber Treatment Ltd, Kuza, Comply Ltd and Muringa Holdings Ltd with an installed capacity of more than one million power transmission poles per year also powering the fraud (Gravin et al., 2017). There was no assessment of suppliers who had a Quality Management System (QMS) that was based on ISO, which was the role of organization basing on factors of production for customer satisfaction. Supply of sub-standard poles or other equipment to the energy organizations causes frequent outbreaks of fire and damaged electrical gadgets in Kisumu County (Tricker, 2005).

The research conducted in Ghana by Ghana Electrical Association (GEA), indicated that the energy sectors was in for making profit but not considering the safety of the customers because no measures were taken to those individuals who bargained for old electrical cables retrieved from old or dilapidated buildings for re-use in their buildings with some also purchased the less expensive ones, claiming the local one were too expensive to afford. This indicated that there was no standard material designed and accepted by energy organizations to use and direct its customers to purchase yet other materials caused hazard. That use of non-copper conductors lead to cable over-heating, fire outbreaks, and electric shocks from walls; and damaged appliances (Cavallini et al., 2007).

According to Cavallini et al (2007), Kenya Power and Lighting Company (KPLC), Kisumu office experienced a fire outbreak at the Information and Communication Technology server room. The chief security officer confirmed that the cause of fire was an electric fault as the room was locked and no one was around when the fire started. This show the need for organization ISO certification requirements on management systems.
to electric disasters quality management service provision were effective or not.

From the analysis, it is clear that the organizations systems in relation to electric disasters quality management service provision were less effective. The research findings corroborates, focus group discussion in which 45 (28%) of the respondents argued that their organization had less effective systems efficiency in relation to electric disasters quality management service provision. That if their systems were effective, they would not be experiencing issues of electric disasters hence satisfaction to their customers. One of the respondents had observation that:

“The fact that our customers have resort into use of alternative source of energy leaves us with lingering questions in relation to our service delivery and this is majorly contributed by weak systems.” (Interview with a KPLC employee, 20th August, 2019 in Kisumu Kibos sub-station).

According to Juran and Joseph (1995), quality management can be ensured through focusing on Quality control (QC). A part of quality management focused on fulfilling quality requirements, is a process by which entities review the quality of all factors involved in production. Quality control emphasizes on three aspects. Elements such as controls, job management, defined and well managed processes, competence, such as knowledge, skills, experience, and qualifications.

According to Dennis (2007), inspection is a major component of quality control, where physical product is examined visually and the end results of a service are analyzed. The quality of the outputs was at risk if any of these three aspects is deficient in any way. For instance, Energy organizations risk the life of its customers because monitoring and predicting devices mounted on their equipment to relay information in case of a hazard prediction. Lack of Communicating risk information and reliable warnings to potentially affected locations through their communication systems made it difficult to counter issues of defect response and this further puts the customers in danger (Anton et al., 2016).

On ISO certification, there is defined part of quality control which focuses on providing confidence that quality requirements has to fulfil. This defect prevention in quality assurance differs subtly from defect detection and rejection in quality control. That Quality assurance (QA) was a way of preventing mistakes and defects in manufactured products and avoiding problems when delivering products or services to customers (Hoyle and David, 2005).

Quality assurance comprises administrative and procedural activities implemented in a quality system so that requirements and goals for a product, service or activity were fulfilled. Defining what suitable product or service quality has been a difficult process, determined in many ways, from the subjective user-based approach that contains the different weights that individuals normally attach to quality characteristics, to the value-based approach which finds consumers linking quality to price and making overall conclusions of quality based on such a relationship (Sadikoglu and Olcay, 2014).

4.3 Influence of state and type of equipment on preparedness and response to electrical fire disasters in Kisumu County

On influence of state and type of equipment on preparedness and response to electric disasters in Kisumu County, out of the response rate of 141 (88) after excluding the customers connected to electricity grid in Kisumu County, 112 (70%) of the respondents were of the opinion of “YES” while 29 (18%) of the respondents had opinion that state and type of equipment had no influence on preparedness and response to electric disasters in Kisumu County.

In relation to the analysis of figure 5.6, Gravin et al (2017), observes that incorrect manufacturing process and use of not suitable materials may cause loss of characteristics of equipment and failures, which can also be a consequence of: Improper package and transportation and inappropriate storage. Incorrect mounting of equipment and materials in these organizations.

Organizations innovativeness of the system solutions for industrial and public distribution is tailored to individual requirements. Some equipment are effective because there was keen measures taken when making them and this makes them reliably optimize quality of service delivery to towards your goals and also customer satisfactory (Sadikoglu and Olcay, 2014). In this case, power quality solutions could be used in all areas of energy supply: from low-voltage to medium-voltage all the way to the high-voltage level because of the type and the state of equipment used.

According Schwenger et al (2014), a stable energy supply with a standard-compliant voltage is an important economic success factor for all applications and was often a prerequisite for grid connection. System perturbations due to insufficient voltage quality resulted in increased costs and in some instances brought business processes to break down. Power quality solutions at place of business contributed to voltage stabilization, compliance with standards and grid connection requirements and a significant increase in grid efficiency.

It is quite common that many manufacturing units, to reduce production costs, do not use low quality or not suitable materials
and do not meet applicable standards. Manufacturing errors of materials supplied by others and not controlled by the equipment manufacturer and this was the consequence of lack of a Quality Management System, for instance wrong forging process. Improper package, not suitable for the particular type of equipment, its fragility, and special requirements of transportation, may cause damages, which of them may not be visible with the preliminary inspection that must be done when equipment arrive to site (ASIS, 2009).

Incorrect handling caused several harmful effects on equipment and materials, presenting similar problems to those referred for improper package and a preliminary inspection. These damages were the origin of failures in systems, equipment and materials (Benson et al., 1991).

4.4 Design Errors of Equipment and Materials Specification

Sizing equipment, like circuit breakers and switching devices, power transformers, motors and cross section of cables and bus bars, a miscalculation by the designer due to the use of unsuitable calculation tools or a wrong evaluation of the data available caused a permanent overload of those equipment, which leads to overheating and dielectric breakdown, or the destruction of equipment they could not withstand short-circuit thermal and electromechanical stress (Glover and Sarma, 2002).

According to Glover and Sarma (2002), when preparing technical specifications, if there were incomplete definition of the characteristics of equipment, an absence of information about the working conditions of equipment and the lack of definition of applicable standards and wiring regulations, a high risk of using unsuitable materials and manufacturing procedures existed, which led to the risk of failures of equipment and materials.

Okwiri (2012), acknowledges that even in qualified and certified manufacturers with installations that met all the requirements, manufacturing errors and deficiencies happened for instance most common factors for such a situation where: manufacturing equipment and machine tools aged and technologically outdated and not properly maintained, disorganized and incorrect manufacturing processes and procedures, unskilled and not qualified personnel, non-observance of applicable standards, use of low quality or not suitable materials and lack of a Quality Management System and poor or lack of quality control. From the findings, it was indicative that the state and type of equipment highly influenced on the preparedness and response to electric disasters in Kisumu County.

V. SUMMARY AND CONCLUSIONS

Most organization have not ensured ISO certification requirements in their management systems. That organizations quality management systems were less effective in relation to electric disasters response.

VI. RECOMMENDATION

The paper recommends that all organization should implement ISO certification requirements on their management systems. Effect their systems through assistance from other organizations with the same role for effective electric disaster management.

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MAINTENANCE OF MANGROVE CRAB (*Scylla olivacea*) SILVOFISHERY SYSTEM STOCKED UP AT DIFFERENT LUNAR PHASES

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ABSTRACT

Mangrove crab is one of the mangrove inhabitants that has high economic value so that it is potential to be cultivated using silvofishery system. This research was conducted in the mangrove area of Mandalle Village, Pangkep Regency, South Sulawesi, Indonesia. The objective of this research was to compare the survival, growth, and biochemical composition of the mangrove crab (*Scylla olivacea*) maintained by a silvofishery system that was stocked with the different lunar phases. The research container used a fixed cage made of bamboo in a circular shape with a diameter of 2.25 m. The test animals used were mangrove crabs (*S. olivacea*) weighing 150-160 g from collectors in Pallime Village, Cenrana District, Bone Regency, South Sulawesi and reared for 30 days. The study consisted of 4 treatments with 3 replications each. The four types of treatment are differences in the beginning of the different phases of the moon, namely: new moon, quarter, full moon, and three quarters. The research data were analyzed using the Kruskal-Wallis analysis and the Mann Withney U test. The results of the Kruskal-Wallis analysis showed that the difference in the moon phase had no significant effect (p> 0.05) on survival, but had a significant (p <0.05) effect on survival, growth and body biochemical composition of mangrove crabs (*S. olivacea*). The best growth and biochemical composition of crab bodies are produced during the new moon phase.

Keywords: Lunar phase, mangrove crab, body chemical composition, growth, survival rate

I. INTRODUCTION

Silvofishery is an integrated activity between the maintenance of aquaculture organisms or in other words, silvofishery is a cultivation activity in mangrove areas to produce fishery products and to conserve mangrove forests (Karim et al., 2019). The basic principle of this cultivation system is the multiple uses of mangrove forests without eliminating natural ecosystem functions so that fishery and mangrove products can still play a role as biological, ecological and economic functions. Utilization of mangrove forests for cultivation activities through the silvofishery system will be important information in increasing fisheries production, especially in maintaining the sustainability of mangrove ecosystem.

One of the aquatic organisms that may be cultivated in mangrove areas with a silvofishery system is the mangrove crab or also known as mud crab. Mud crab (*Scylla* spp.) is one of the high economic value fishery commodities and is very popular because it has good nutritional content. Crab meat contains essential amino acids, protein, unsaturated fatty acids and is also an excellent source of minerals such as calcium, iron, zinc, potassium and phosphorus (Sarower et al., 2013; Ramamoorthy et al., 2016; Barathi et al., 2018). Therefore, mangrove crabs are very suitable to be cultivated in mangrove areas because they are their natural habitat.

Several aspects that need to be considered in the cultivation of mud crab is the nature or habit of this crab to run away and dig holes. Besides being assessed by the level of obesity or growth, crab quality can also be assessed by the quality of the meat produced in the form of its nutritional content such as protein, fat and energy. Therefore, in order to produce quality mud crab requires knowledge of the nature, cultivation techniques and factors that influence the activity and behavior of crabs including natural factors. One of the factors that influence the activity and behavior of crabs in nature is the moon phase (Mirera, 2013; Hasnidar and Tamsil, 2019).

The moon’s phase is the shape of the moon which always changes when viewed from the earth, depending on the position of the moon to the sun when viewed from the earth. The lunar phase periodically during one month changes which recur in one year,
which can affect foraging, migration or reproduction patterns (Smith et al., 2011; Pentiriani et al., 2013; Navarro-Castille and Barja, 2014). This phenomenon becomes something that affects the waters physically, chemically and biologically. This condition results in the behavior of aquatic animals in it, including mangrove crabs. Moon phase can affect aquatic biota in general, either directly or indirectly. The direct effect on the cycles of the moon's phases is the direct influence on the biology of mangrove crabs such as growth, reproduction and feeding habits. The indirect effect is the influence of the moon / sun's gravity on the dynamics of the physical and chemical conditions of marine waters so that it may affect mangrove biology (Scylla sp.). The moon phase affects the physiology and behavior of marine organisms, especially in aquatic invertebrates (Kronfeld-Schor et al. 2013; Fazhan et al., 2017).

Lack of information regarding the appropriate propagation or initial phase of maintenance in mangrove crab cultivation is important to study in order to produce maximum survival, growth, and nutrient content of mangrove crab meat. In order to get an overview of the initial distribution of the lunar phases of survival, growth, and biochemical composition of mud crabs (Scylla olivacea) maintained by the silvofishery system, research on this needs to be done. This study was aimed to compare survival, growth, and body biochemical composition of mangrove crabs (S. olivacea) maintained by the silvofishery system stocked with different early moon phases.

II. RESEARCH METHODS

The research was conducted in the mangrove area of Mandalle Village, Mandalle District, Pangkajene and Islands Regency, South Sulawesi Province, Indonesia. Proximate analysis of crabs was carried out at the Animal Feed Chemistry Laboratory, Faculty of Animal Husbandry, Hasanuddin University, Makassar.

The research container used a fixed cage made of bamboo in a circular shape with a diameter of 2.25 m and embedded in the mangrove Rhizophora area. To keep the water circulating in the cage running smoothly, the bamboo halves are spaced about 1 cm apart from each other. The outer part of the cage was covered with a waring which aims to protect the cage from garbage and dirt carried by the waves.

The test animals used were mangrove crabs (S. olivacea) with a weight of 150-160 g per head. The crabs were obtained from crab catchers in Pallime Village, Cenrana District, Bone Regency, South Sulawesi and kept for 30 days. Before the crabs are spread into the research container, their weight is first selected by weighing it using a digital sitting scale with an accuracy of 1.0 g and adapting it to environmental conditions for 2 days. During the adaptation period, the crabs are given food in the form of chopped Tilapia once a day.

The feed used was trash fish in the form of minced Tilapia fish. Feeding was given once a day, namely in the afternoon at 5pm with a dose of 10% of the crab biomass.

The study consisted of 4 treatments with 3 repetitions each, so this research consisted of 12 experimental units. The four treatments are differences in the time of distribution based on the phases of the moon, namely: new moon, quarter moon, full moon, and three-quarter month.

The parameters observed in this study were survival, absolute growth, and body chemical composition of crabs.

Survival rate was calculated using the following formula:

\[ SR = \frac{N_f}{N_0} \]

Note: \( S \) is survival rate (%), \( N_f \) is the number of live crabs at the end of the study, and \( N_0 \) is the number of crabs at the beginning of the study.

The absolute growth of crabs was calculated using the following formula:

\[ W = W_t - W_o \]

Note: \( W \) is the absolute growth of mud crabs (g), \( W_o \) is the average weight of crabs at the beginning of the study (g), and \( W_t \) is the average weight of crabs at the end of the study (g).

The measured body chemical composition was protein, fat, and energy. Protein was analyzed using the Kjedal method, fat with the Soxlet method, and energy was measured using a calorimeter bomb. The analysis was carried out by following the AOAC procedure (2016).

As supporting data, during the research, several parameters of water chemistry and physics were measured, including: temperature, salinity, pH, dissolved oxygen, ammonia, and nitrite. Temperature, salinity, pH, and dissolved oxygen were measured twice a day i.e. in the morning (6am) and evening (5pm). Ammonia and nitrite were measured three times during the study, namely at the beginning, middle, and end of the study.

The data obtained were analyzed using non-parametric statistics (Kruskal Wallis and Mann Withney U test). As a tool to carry out the statistical test, the SPSS version 23.0 program package was used. The water quality parameters were analyzed descriptively based on the feasibility of mangrove crab life.

III. RESULTS AND DISCUSSION
Survival and Growth Rates

The survival and growth rates of mangrove crabs stocked with different lunar phases are presented in Table 1.

Table 1. Average survival and absolute growth of the mangrove crabs

<table>
<thead>
<tr>
<th>Moon Phase</th>
<th>Survival Rate (%)</th>
<th>Absolute Growth (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>100 ± 0.00</td>
<td>16.98 ± 1.48a</td>
</tr>
<tr>
<td>A Quarter</td>
<td>100 ± 0.00</td>
<td>14.01 ± 0.66ab</td>
</tr>
<tr>
<td>Full Moon</td>
<td>96.67 ± 5.77</td>
<td>7.82 ± 0.59c</td>
</tr>
<tr>
<td>Three-Quarter</td>
<td>100 ± 0.00</td>
<td>11.87 ± 2.65b</td>
</tr>
</tbody>
</table>

Note: Different letters in the same column show a significant difference between treatments at the 5% level (p <0.05)

The results of Kruskal Wallis analysis showed that the moon phase had no significant effect (p> 0.05) on survival, but had a significant effect (p <0.05) on the growth of mangrove crabs. Furthermore, the analysis results of Mann Withney U showed that the growth of crabs spread on dark powder was significantly different (p <0.05) from the full moon and three-quarter moon, but did not show a significant difference with the quarter moon. Likewise, the quarter and three-quarter months do not show a real difference, but are significantly different from the full moon.

Chemical Composition of the Crab Body

The body chemical composition of the mangrove crabs stocked with different moon phases is presented in Table 2.

Table 2. The body chemical composition of the mangrove crabs stocked with different lunar phases

<table>
<thead>
<tr>
<th>Moon Phase</th>
<th>Protein (%)</th>
<th>Fat (%)</th>
<th>Energy (Kkal/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>46.41 ± 1.23a</td>
<td>13.22 ± 0.23a</td>
<td>4.602 ± 31.19a</td>
</tr>
<tr>
<td>A Quarter</td>
<td>44.08 ± 0.69b</td>
<td>11.69 ± 0.23b</td>
<td>4.313 ± 36.72b</td>
</tr>
<tr>
<td>Full Moon</td>
<td>41.84 ± 0.35c</td>
<td>10.46 ± 0.45c</td>
<td>4.016 ± 75.34c</td>
</tr>
<tr>
<td>Three-Quarter</td>
<td>43.55 ± 0.19bc</td>
<td>12.68 ± 0.52bc</td>
<td>4.334 ± 70.31b</td>
</tr>
</tbody>
</table>

Note: Different letters in the same column show a significant difference between treatments at the 5% level (p <0.05)

The results of Kruskal wallis analysis showed that the moon phase had a significant effect (p <0.05) on the protein, fat, and energy content of mangrove crabs. Furthermore, the results of the Mann Withney U test showed that the protein, fat, and energy content of the mangrove crabs that were stocked in the new and full moon phases were significantly different (p <0.05) from other phases of the moon. However, between the phases of the quarter and three quarters of the moon did not show a significant difference (p >0.05).

Water Quality

During the research, the physical and chemical environment of mangrove crab maintenance were also measured. The range of physical and chemical environmental values for mangrove crab maintenance during the study is presented in Table 3.

Table 3. The range of environmental water quality values for crab rearing during the study

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>25-31</td>
</tr>
<tr>
<td>Salinity (ppt)</td>
<td>25-30</td>
</tr>
<tr>
<td>pH</td>
<td>7.11-7.90</td>
</tr>
<tr>
<td>Dissolved Oxygen (ppt)</td>
<td>3.30-5.18</td>
</tr>
<tr>
<td>Ammonia (ppm)</td>
<td>0.005 – 0.024</td>
</tr>
<tr>
<td>Nitrite (ppm)</td>
<td>0.25 – 0.42</td>
</tr>
</tbody>
</table>

Discussion

Mangrove crabs reared in various lunar phases produce the same survival rate. This illustrates that the different phases of the moon do not have a significant effect on mangrove crab survival. The survival rate obtained in this study is very high, i.e. 96.67-100% (Table 1). The high survival rate of crab is due to the sufficient level of feed given to support the maximum crab survival. Feed is a determining factor for the survival and growth of mangrove crabs (Soundarapandian et al., 2013; Karim et al., 2017).

Another factor that causes high crab survival is because the mangrove area as a maintenance location is a natural habitat for crabs. Mangrove vegetation is a characteristic of the coastal ecosystem which is the original habitat of mangrove crabs, a place where mangrove crabs live, breed and forage. Mangrove crab populations are typically associated with mangrove vegetation that is still in good condition (Rajpar and Zakaria, 2014; Cuenca et al., 2015). Tahmid et al. (2015) suggested that there was a relationship (positive correlation) between the quality of the mangrove ecosystem as habitat for mangrove crabs (Satheeshkumar, 2011; Clough, 2013; Lapolo et al., 2018; Redjeki et al., 2020).
The absolute best growth of mangrove crabs was produced in crabs that were stocked at the new month and quarter, while the lowest was at the full moon. In the new moon and a quarter of the light intensity is lower so that the activity of foraging by crabs increases. This is related to the eating activity of crabs which are classified as nocturnal species (Lucrezi, 2014). In dark conditions, crabs are actively moving and looking for food (Hastuti et al., 2019). Ruaya activity for obtaining food can occur in dark conditions, as can culture behavior in other crustacean species (Shelley and Lovatelli, 2011).

The best protein and fat content of mangrove crabs is produced in crabs that are stocked on the new moon and the lowest is at the full moon. The data obtained has a positive correlation with the growth data of mangrove crabs, so it is confirmed that the addition of cells in the carapace space results in internal body growth. In addition, the presence of the moon phase as an external factor plays an important role for anabolic activity in the form of increased protein synthesis in the crab body. High protein and fat content is an indicator of increased growth (Dayal et al., 2019). The change in the percentage of protein and fat at each phase of the month indicates the use of protein to build body tissue, and as a source of energy and for the formation of body fat.

The body chemical composition reflects the bioenergetic growth of mangrove crabs that are kept in the mangrove ecosystem. High protein content is one indicator of increased growth. The percentage of body chemistry obtained in this study is assumed to be the energy reserve of each individual crab. The behavior of crabs in mangrove habitats that are active foraging at the new moon is assumed to be an effort to meet energy reserves for various activities including movement, adaptation, metabolism, reproduction and growth.

Utilization of fat in the body as a source of energy and formation of body fat can be observed through changes in the percentage of fat, which occur at each phase of the month of observation. Fat in the body has a major role as a component of cell membranes, provides energy reserves and is a factor in cholesterol synthesis. In addition, body fat acts as an insulator which has a role in the protection of important organs. This study found differences in protein and fat content obtained from body chemistry in different months of observation. Therefore, the main role of protein and fat as a source of energy, the energy of the mangrove crab body that is maintained silvofishery can be used as an indicator of crab energy. Based on Table 2, the higher the protein and fat content of the crab, the higher the energy content, and vice versa. The results of this study indicate that the average energy content of mangrove crabs that are stocked on the new moon is the highest and the lowest on the full moon. The availability of energy in the body of mud crabs is the basic modality for growth. Through silvofishery maintenance, the researcher hopes that the factors that cause stress due to environmental stress can be avoided, so that energy reserves can be proportionally utilized for growth.

The differences in protein, fat, and energy content affect the absolute growth of mangrove crabs. The higher the body's nutrient content, the faster the growth will be. This can be seen from the absolute growth of crabs (Table 1) where the absolute growth of crabs was highest in crabs that were stocked for the new month. Growth is described as an increase in body protein, fat and energy. Organisms tend to have an optimal biochemical composition depending on their adaptation strategy. Body fat content is an expression of an animal's adaptive characteristics. Silvofishery maintenance of mangrove crabs has similar advantages to natural habitats. The maintenance method still maintains the mangrove area as the original living place for crabs. Based on Table 3 above, it is obtained that the environmental water quality for crab maintenance is temperature ranging from 25-31 oC, pH 7,11-7,90, salinity 25-30 ppt, dissolved oxygen 3.30-5.18 ppm, ammonia 0.005-0.024 ppm, and nitrite 0.25-0.42 ppm. The range of these values is feasible to support the life of mangrove crabs. The optimal temperature for mangrove crab growth is 26-32 oC, salinity 15-30 ppt, pH range 7.0-8.5; dissolved oxygen> from 3 ppm, ammonia <0.1 ppm and nitrite <0.5 ppm (Shelley and Lovatelli, 2011; Karim, 2013; Pedapoli and Ramudu, 2014).

CONCLUSION

The best survival rate, growth rate, and chemical composition of mangrove crabs are produced in the new moon.

REFERENCES


Instrumentation of a robotic arm with graphical interface

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Abstract- The present project consists in the effective instrumentation of a robotic arm to control it, improving the precision of its movements and monitoring its position, to later control the movements of the arm. A graphical interface was created in the Processing platform that shows the position of each arm joint and at the same time it helps to manipulate its movements. The computer induces the Processing program to send instructions to the Arduino board based on the value of the virtual knob that the operator entered.

Index Terms- Arduino, Graphical interface, Instrument, Processing, Robotic arm, Raspberry

I. INTRODUCTION

The use of instruments dates back to the beginning of human civilization. As man developed, there was also a growing need to measure certain parameters that were required to reduce his daily activities, such as weight, temperature, time or flow. Industrially, in the early 1920s, the formal development of instrumentation took place due to the requirements of new industrial processes, such as oil refining, dairy pasteurization or electricity generation. Instrumentation has allowed current technological advancement such as the automation of industrial processes, since automation is only possible through elements that can measure physical variables and/or transmit what happens in the environment, in order to take an action of pre-programmed control that acts on the system to alter said variable obtaining the expected result. Instrumentation is the set of sciences and technologies by which physical or chemical variables are measured for evaluations and/or actions based on the information obtained.

With the characteristics it possesses, instrumentation implementations can be carried out in different areas, processes, equipment and tools, such as a robotic arm, one of the most widely used tools in today's industry. This device is one of the present technological culminations that have been developing since the end of the 18th century and the beginning of the 19th century, when numerical control programmed machines for industrial use began to be implemented, such as a weaving machine for the textile industry in which it was possible to choose the type of loom to weave using punched cards. This machine was part of the beginning of automation.

Thus, it is possible that through instrumentation, a robotic arm can be enabled, measuring analog and location variables, to interpret, evaluate and subsequently alter them, resulting in easy manipulation of the arm and optional automation of the same for processes and tasks that it’s capable of carrying out, and therefore could be useful, for example, for assembly on a production line, or as a learning prototype to configure a series of instructions to be performed as practice.
II. THEORETICAL FRAMEWORK

Raspberry
"The Raspberry Pi is a low-cost reduced board computer, single board computer or simple board computer (SBC) developed in the UK by the Raspberry Pi Foundation." (Sánchez, 2018, p. 21).
The Raspberry board can perform the same tasks as a normal computer, such as play audio, play video, play games, surf the Internet or manipulate documents.

Processing
Processing is an open source software, and anyone can contribute to its improvement. Without unnecessary interfaces, it uses a Java-based programming language (of the same name). It basically consists of a simple text editor to write code, a message area, a text console, a tab system to manage files, a toolbar with common action buttons and a menu bar (Buioli and Pérez, 2013, p. 4).

Arduino
Arduino is a single-board free hardware microcontroller system, easy to use and of low cost, initially developed to facilitate the use of electronics in artistic and interactive designs and its application by non-experts. To facilitate its use and programming, an IDE (integrated development environment) was developed simultaneously and together with the Arduino platform, in which a programming language similar to C++ is used, based on the Wiring language, the development environment is based on Processing (Herrero and Sánchez, 2015, p. 4).

III. METHODOLOGY AND DEVELOPMENT

The following diagram represents the system created to control the robotic arm:

![System diagram](source: own elaboration. 2020.)

- Interface algorithms and control instructions: These are the algorithms that will provide the design and image to the interface, such as the algorithm called "event" which detects each value sent to the serial monitor through a specific point on the screen.

- Control screen: Provides the main view of the control interface where it has display and control algorithms, as shown in figure 2.
Serial Port: A COM port is a serial port on a computer, which is a slot that allows the connection of peripheral devices (such as a mouse or modem) to the computer via cable. They have been replaced by the small USB (Universal Serial Bus) connectors and in this case, a virtual serial port was used to communicate Processing and Arduino.

Data conversion algorithms: In the main program the data sent from Processing is read and Arduino stores this data in programmed places according to the type of value that arrives, in this case characters of the type "char" are handled.

Controller: The controller is characterized by having the code that will be able to perform the tasks assigned to it with the help of its analog type connection pins for reading and controlling digital signals.

Comparator: Its task is to compare the sensor position readings and measure how far the robotic arm is from the position that is requested and for this, the program makes the decision to send a pulse to two pins destined as left or right to control the rotation of a motor in either of these directions.

Amplifier: Since the Arduino signal goes from 0 to 5 volts and our motors need 7 volts, the voltage is insufficient, so a power stage with a L293D Driver is used, which is an integrated circuit designed to control motors using an H bridge. It has 4 channels, and it’s capable of being designed to handle 2 channels and full H bridge. This way it was possible to design the circuit board for the power stage as shown in figure 3.

Motor: In this section the actuators are manipulated by the entire closed loop type control system.

Sensor: It’s a potentiometer coupled to the motor to obtain its position. This data is monitored by the microcontroller to define what decision will be made according to what the user wants.
Development

The first step was to experiment with potentiometers attached to the joints of the robotic arm (see figure 4) to obtain measurements of the movement variables in order to manipulate them. For this, and with the help of Arduino, tests were carried out by sending numerical data to observe the adjustment of the movements of each joint; the potentiometers then sent analog values from 0 to 1024. With the help of the “map” function a conversion of these values to degrees was made, obtaining measurements of the position of each joint, adjusting to the required location using the 5V motors. In this last part, a power drop was discovered in the motors when energized, for this reason, a power amplification stage was added to compensate for it.

![Figure 4: Robotic arm with potentiometers attached to it. Source: own elaboration. 2020.](image)

Once the method to manipulate the location values of the arm was known, a graphical user interface (GUI) was created with the help of the Processing software, for this, we started by creating virtual knobs and sliders using the "ControlIP5" library. The values sent by Processing are marks and numeric values, which Arduino stores for a short period of time and defines the destination of the signal, that is, to which joint it sends it to move it.

Once the Arduino board is ready to send the signal, it first passes through the power amplifier to provide enough power to compensate for the aforementioned power drop and move the target motor, as well as making it possible to reverse its rotation.

To make the transport of this entire system more practical, it was adapted to a touch screen and Raspberry pc board, the GUI appears on the screen, showing the virtual knobs with their sliders to facilitate manipulation for the operator.

IV. RESULTS

According to the movement instructions that the user enters to control each joint, the arm takes approximately two seconds to perform the movement; however, the movement is precise. Thus, a practical and intuitive system that anyone can use is obtained.

V. CONCLUSIONS

The design and its components, although practical, can still be improved in different ways, such as using flex sensors instead of potentiometers, reducing the response time of the arm when an instruction is entered in the interface, and so on. As it is a system created in free software, new conditions or algorithms can be introduced to adjust the program to different needs.
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The Concept of 'Survival' in Diasporic Journeys: An Application of Maslow's Hierarchy of Needs on Jean Arasanayagam's "The Journey."

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Abstract – This research paper aims at looking at a diasporic journey portrayed in the short story "The Journey": which is one of the nineteen short stories from the war-ravaged Sri Lanka written by Jean Arasanayagam and published under the title All is Burning as a compilation. It is a story which deals with the description of an illegal diasporic journey taken up by a group of migrants from Sri Lanka to reach Berlin, in the guise of asylum seekers. The members of this migrant group belong to two different ethnic groups, namely Tamil and Sinhalese, who are looked as strangers and enemies in their homeland. By using the textual analysis method, and the application of Abraham Maslow's Hierarchy of Needs, the research paper aims to look at the concept of 'Survival' in this diasporic journey and how this concept helps in strengthening the ethnic relationships between the migrants. It is identifiable that this important concept plays an essential role in enabling this ethnic relationship within.


I. INTRODUCTION

There have been various researches done previously concerning the ethnic relationships and lifestyles of the post-colonial Sri Lanka and the influence they have on the Sri Lankan diaspora communities. The understanding of ethnic relationships based on the past contexts and especially the decades of war in Sri Lanka is essential. There has been a tremendous change taking place in terms of the lifestyle of the post-colonial Sri Lanka, both in its cultural exposure and political demands.

The ethnic relationships in the island nation and the lifestyle observed through the decades of war have to be understood both through the lenses of the past and the present. At this juncture, Jean Arasanayagam's collection of short stories All is Burning has to be looked for the instances where the author had attempted to portray few of the regularities in the ethnic relationships of the nation and also of the changing lifestyles over the recent decades in the post-colonial era.

In a review of Jean Arasanayagam's All is Burning, by Sudeep Sen, published in World Literature Today, he mentions saying, "It is a collection which deals with many of the familiar issues and subjects of her poems, including social unrest, politics, postcoloniality, and the identity and definition of womanhood. Arasanayagam's stories have a docudrama quality about them, wherein fictional imagination, reflected reportage, and personal experience and observation all contribute to display the truths and untruths of the Sri Lankan world" (Sen 478). It is a description which encompasses the whole content of the collection of short stories and will be a useful tool to provide varied perspectives to look at Jean Arasanayagam's writings throughout this research. The perspectives such as, looking at the ethnic relationships and lifestyles through the lens of themes expressed in her poems, incidents relating to the social unrest, the political influence in the ethnic relationships, the colonial effects which have been held on through the decades in this interrelations, the search for the identity of self and ethnic community, and also the description of womanhood in the post-colonial, war-ravaged era in the country are brought into awareness through this claim.

The journal Asia Survey contains a research article 'Sri Lanka in 2010' by Jayadeva Uyangoda, where the two key events of 2010 in Sri Lanka such as the respective presidential and parliamentary elections, which enabled the government to consolidate power in both the executive and legislative branches of the state in the post-civil war era are studied (Uyangoda 137). The study concludes stating that regime priority has been toward political consolidation, rather than ethnic reconciliation and a political solution to potential ethnic tensions in the country. This is a critical element in terms of placing Jean Arasanayagam's short stories in the context of the post-war situation. The possibilities of ethnic reconciliation can be understood in terms of the efforts from the government's side.

From the selected short stories of Arasanayagam from All is Burning, there are incidents where she points at the deliberate attempts of the characters in the short stories trying to minimise the gap in the relationship of the different ethnic individuals, despite the barriers such as language and way of living. There is also the limitation of the study being only conducted in the eastern part of the country, which may not be a whole
representation of the real picture, around the country. Thus, there is a space for the stories, especially "The Journey" to be analysed in search of Jean Arasanayagam's description of relationships in other parts of the country. In the article published in the journal The Sociological Quarterly by Zan Strabac and Kristen Ringdal titled "Individual and Contextual Influences of War on Ethnic Prejudices in Croatia," the understanding of what the determinants of ethnic prejudice in Croatia were in the aftermath of the 1991-1995 war is conducted through the study. The analysis is based on a nationwide survey conducted in March and April 1996, less than a year after the cessation of war activities in Croatia. The main focus of the analysis is on how war influences the ethnic prejudice of individuals. The influences of individual war-related experiences and the effects of regional differences in the level of war activities are analysed simultaneously by conducting a multilevel analysis. The important findings of this study are that individual war-related experiences have little impact on prejudice, but that the contextual influence of war is somewhat stronger. Variables that are not directly related to the conflict such as education, religiosity and size of the place of residence have the strongest effect on prejudice. The study also suggests that the results can be generalised to other large-scale ethnic conflicts, which indicate that a recent history of conflict is not in itself a major hindrance to the process of ethnic reconciliation (Strabac and Ringdal 796). Reference of this research study and the results would be a perspective of a comparative ethnic conflict, the individual experiences and their influences on the reconciliation process while we attempt to understand Arasanayagam's writing.

In order to look at the ethnic relationships and the lifestyles of the different communities in the post-colonial era, there has to be a close analysis of Arasanayagam's reference to the colonial time and the post-colonial relevance. The Journal of Peace contains a research article titled "Escaping the Symbolic Politics Trap: Reconciliation Initiatives and Conflict Resolution in Ethnic War" by Stuart J. Kaufman. It involves in studying existing approaches to resolving civil wars that are based primarily on the assumption that these wars result from conflicts of interest among rational individuals. However, peacebuilding efforts based on this approach usually fail in cases of ethnic civil war, leading sooner or later to be renewed fighting. Symbolic politics theory suggests the problem with these peace efforts is that they pay insufficient attention to the emotional and symbolic roots of extremist ethnic politics (Kaufman 218). The theory suggests that resolving ethnic war requires reconciliation — changing hostile attitudes to more moderate ones, taking away ethnic fears, and replacing the intragroup symbolic politics of ethnic chauvinism with a politics that rewards moderation. The only policy tools for promoting such attitudinal and social changes are reconciliation initiatives such as leader's acknowledgement of their sides' misdeeds, public education efforts such as media campaigns, and problem-solving workshops. Integrating such reconciliation initiatives into a comprehensive conflict resolution strategy, it is argued, is necessary for conflict resolution efforts to be more effective in ending ethnic civil wars. Jean Arasanayagam's "The Journey" can be viewed as such an effort which has the potential of leading towards a possible reconciliation both in the political and the ethnic level.

In accordance to the above references made regarding the collection of short stories by Jean Arasanayagam, and the thematic understanding of the various works of hers, this research attempts to understand the possibilities of the reconciliation through ethnic relationships in the diasporic context through her short story "The Journey".

II. SYNCHRONISATION OF THEORY

The concept of survival in the journey, which lays importance on the needs of an individual, can be looked through the framework of Abraham Maslow's Hierarchy of Needs. The narrator in the story, who aims at the highest level of perfection by taking up this journey, is brought down through the different levels of Maslow's Hierarchy of Needs, where in basic needs such as food, clothing and shelter become primary demands.

III. METHODOLOGY

This research study uses the textual analysis method. By close analysis of the nuances of literary expressions, the analysis will study the text in order to find the synchronisation of the theory. The passages of the text that project potential ideas on the concept of survival and possible platforms for the application of the theory will be chosen as samples for the study.

IV. ANALYSIS

Arasanayagam's short story, which describes a diasporic journey in the recent past brings in an important argument of 'survival'. As a group of migrants, who are taking up a journey which is illegal and is encountered with numerous risks, there is a clear description of how the need to survive brings in the realisation amongst the migrants that they need each other for their survival.

Referring to Maslow's Hierarchy of Needs, the story gradually shows how as the identity of the people is being lost, the needs according to Maslow's hierarchy comes down all the way to the bottom level, where the basic needs to survive gain importance. The individuals who aimed at the highest level of perfection through enlightenment and those who were searching for the safety and security of their belongings are now depending on each other for the basic needs such as food, clothing and shelter (warmth in the cold environment) for their instant survival. Thus, the needs of these migrants can be analysed at different levels.

We maintain silence most of the time. I have no one to talk to in my own language at any rate. Nor can we speak in each other's language. We use signs to communicate with each other when the necessity arises" (Arasanayagam 3).
Being the only Sinhala male in a group of migrants where others are Tamils from the North of the country, the question of ethnicity and the relationship between them is questioned in terms of the language. The unfamiliarity of the language between the ethnicities has been a cause for fewer communication attempts in the past. Each ethnicity not knowing the other's language has been a cause for less communication between the ethnicities and thus less understanding of each other. The need for a common language or the familiarity of other's language is an important element in the process of building healthy relationships between the ethnicities. Arasanayagam places this question amongst the migrants in this journey and tries to find out how they overcome this obstacle. Surprisingly we find that the need for survival and the inclination to stay as a group brings in a way to communicate.

There is no letting go even for a moment. And always to remember that we are a group. Numbers. Each of us is a number. The numerals reverberate in our minds: sixteen of us, seventeen with the guide. No one should go missing” (Arasanayagam 4).

The need for survival and the need to stay as a group move the migrants further to establish a way of communicating with each other; they use signs to communicate. This is one possibility of co-existence the story deals with, which arises the question, whether back at home the same need for survival and the inclination for living together as one nation was encouraged. Thus, the group of migrants who are on their diasporic journey become an example of how the initiative taken by them to overcome the difficulty of communication provides a way for them to stay together as a group and to depend on each other for survival. This enables the migrants to understand the importance of being together as a group, throughout the journey, in order to reach the destination.

In Moscow we were all put in one room. It was winter. There was no heating. We were grateful for the warmth of each other's bodies. The comfort of each other's breath. Our being together (Arasanayagam 6).

Apart from the purpose of being together as a group of migrants during a diasporic journey in order to ensure the safety and security of each other, the need for survival brings down all prejudices, differences and comparisons to the basic level of human beings who have a regular and constant challenge to live with the nature around and to survive. The hard and difficult journey, since through an illegal way, demands the migrants more than just security. The passage referred above becomes an example of how each other's gratefulness of the warmth of each other's bodies and the comfort of each other's breath given during the journey becomes an important factor on the bonding of each other. Being safeguarded from the cold weather as a basic need of human beings, the realisation that the 'being together' is essential becomes clear. It is a question of basic needs. And when such importance is realised in the basic levels of needs, than the higher ones, there is a well-established relationship between the migrants. They are brought down to the level depending on each other not just for the safety and security of but for the basic need of food, clothing and shelter.

The narrator says:

Just a little human feeling. We weren't divided in this country according to our racial or ethnic groups. We hadn't brought our weapons, our arms to this country. We didn't bear labels here-terrorists, militants, subversives, misguided youth […] Those identities had been left behind. We had a different mission here. The journey. The pilgrimage. We weren't a warring people here (Arasanayagam 6).

The above extract shows the realisation of the basic human instincts amongst the migrants. Depending on each other for survival is portrayed in the passage above. The realisation of the need to be together is not just a deliberate attempt or a choice for the group of migrants, but a basic need; "Just a little human feeling", according to the narrator. The realisation of this dependence on each other for safety and security, the identities left behind in the homeland from where they left, the remembrance that there is a mission to be achieved and the need to survive together as a group brings in the co-existence, which is essential for the people with different ethnicities to function together as one efficient system towards a common goal.

The prejudice one has about the other (in this context the ethnicity) is provided with a space to be re-understood and relevant during this journey. The understanding of each other with the recent attempts to communicate, the need to survive and the circumstances which demand each other's dependency in terms of safety, security, motivation and basic needs such as food, clothing and shelter become the factors which influence this realisation.

The basic idea that the identities left behind have positively influenced the relationship is an indication that the neutrality of platform for ethnic interaction to happen is a necessity. The members of this diasporic community got the opportunity and chance to have such an interaction only when they left their personal and ethnic identities behind. The assurance of being not divided according to their racial or ethnic group becomes an influential factor to ensure that they are able to depend on each other. The loss of ethnic and racial identity together with the need to survive positively influences the co-existence.

I look at the woman, the child. It’s so cold. Freezing. She keeps the boy close to her all the time […] His body still trembles, perhaps more with the tension and exhaustion than with the cold. I have one jerkin too many. I hold it out to him” (Arasanayagam 13).

As a way of initiating inter-ethnic interactions, the author has brought in representations of both the ethnicities. The narrator, being the only Sinhala male in the group of migrants, is interacting with a mother and her child who are from the Tamil community of the North. The rest of the group is placed in the background as contributing majorities for the story. In the country, the statistics is the other way. The Sinhalese
community is the majority. But here, in this group of asylum seekers, the Tamils from the north of the country are the majority.

The interaction initiated between the narrator of the story and the mother and child is representational of what Arasanayagam is trying to portray through the story. This is an example of the interaction between the representatives of the ethnicities at the basic level of need. There would have been several reasons for the ethnicities to have a mutual relationship in terms of safety and security. But the basic level of needs which demanded the safety from the natural environment to survive, to have the proper clothing to keep away the cold weather, brings in the interaction which is surprising for the same individuals involved in the interaction. It places the basic question of whether human beings need to be brought down to the basic needs of survival to understand that each other are of the same species with the same basic needs to survive.

The identities which defined the ethnicity, race and culture tradition are all lost. Whether, as mentioned earlier, the shedding of such identities have brought in the enlightenment to respect each other as human beings with the same basic needs. The incident indeed influenced both, the acceptance of each other in the story and also the understanding of the purpose of such an attempt by the author to bring in a circumstance as this. For the incident concludes as the narrator's words relate to his realisation as follows.

The boy’s thin shoulders are covered with my jerkin. They stop shaking. He looks at me as if at an elder brother. What is there to divide us at this moment? Nothing. Even lack of a shared language is no barrier to our communication (Arasanayagam 13).

Amongst the ideas expressed about the identity of the diaspora during the journey and the need for survival which brought in realisations and understandings of each other, it is the consequences of such an important journey.

Each one is concerned about himself but is aware of the others too. We will not abandon the weak. There is an unspoken bond between us now. I’m not one of them but it no longer matters. It will never matter again” (Arasanayagam 14).

What would be the later effects of such an experience? What hope does this journey bring into the life of this diaspora community in the host-land? Is there a positive influence expected in terms of co-existence of this community and a healthy ethnic relationship to follow. This question, indeed, paves a way for a later discussion or a study on how the experiences of the diasporic journey influence the ethnic relationships in the host-land.

But, the above mentioned lines provide a hope. Not being one amongst a different ethnic group is no more an element which would hinder the relationship between the individuals. The hope relies in the belief that it will never matter again. A hope that, in the host-land the relationships between these individuals, though from different ethnicities of the same nation who are otherwise looked as enemies, will be healthier than in the homeland. A new identity and experience of dependency on each other for survival have brought in the expected change; hopeful, but not assured.

This becomes an example of the realisation that when it comes to the choice between politics of the country or survival, it is the survival which wins. The dangers each face have been the same that have been gradually leading the migrants to realise that, all of them, as members of the same migrant group are depending on each other for survival. And the experiences of the journey have taken them all the way to the realisation that they need to share the basic needs equally within them.

There is no more space for the ethnic prejudices to influence the choices they take. They have been together in a journey, which did not just demand the highest perfection in life, or the safety and security assured, but also the basic needs which had to be shared without barriers. This realisation becomes an important factor in the process of the diasporic journey and its influence in the understanding of each other's ethnicity.

There were different stages of this journey which demanded a choice to move further at a particular period of time. There was motivation needed from each other's side to sustain in this journey of survival. Nicholas Van Hear refers to such a crucial issue in a diasporic journey. According to him, migrations can be having contributing elements in several ways. There would be stages in the migration process where motivations may be mixed to at the point of making the decision to move. People find themselves amongst mixed motivation and aim during their journey and on reaching their destination (Van Hear 36). Thus, these similarities amongst mixed crowds, moving along with different intentions, there is a contribution from each other is demanded in order to ensure that everyone survives in this journey and reaches the aimed destination.

Looking at the extent to which the dependence on each other to survive in this difficult journey has gone, it is interesting to find out that there was nothing left for them to feel strangers to each other anymore. Even though, throughout the journey they have been depending on each other's physical and moral support, there are few significant incidents which clearly removed the boundaries within them, both physically and mentally. The narrator describes one of the incidents as follows. The narrator says:

When the call finally came we were asked to get into the back of a huge container truck. It was already packed with heavy wooden crates […] We had to lie one on top of the other the way firewood is loaded in our country […] We were conscious of the bodies beneath ours, their breathing almost imperceptible, trying to be still as possible so as not cause the other discomfort. Layers of bodies. (Arasanayagam 10)
The incident is, indeed, one of the closest encounters which physically this group of people experienced. The group as one body, yearning for survival, had to adhere to the regulations which the circumstance demanded. But as they underwent through these difficulties, there were assured that each other would remain without providing discomfort to the other. They had to be together through these circumstances to ensure that everyone safely reach the destination. Such incidents were exceptional in providing the assurance that they are not a danger for each other's survival.

David Richardson comments on such similar experiences of the slavery and the black Atlantic, as that the socially destructive elements found in the slavery trade of the Atlantic should not keep us away from looking at the potential the Africans had to take it up as a challenge, and if they survived the Atlantic crossing, they were able to reconstruct meaningful lives and also create enduring legacies as a diasporic community. The challenging experiences included dehumanising experiences such as force marched to the sea and packed sardine-like on board ship (Richardson 32). The group of migrants journeying here also have the same potential. They have taken up this challenge to go through this, but their survival means a diasporic well-being in the host-land.

One of the important realisations expressed by the narrator triggers more questions which can be an influential factor in proceeding with the research. The neutrality of the understanding of each other, which is new to them, is presented unbiased by emotions.

"We do not look upon each other as brothers, nor do we look upon each other as enemies. We can learn a lot about survival from each other. Even without a shared language" (Arasanayagam 9). The lines referred above deals with two important things the neutrality of the emotions and the unbiased and unprejudiced relationship. Even though the members of this group of migrants have been going through circumstances which have the potential of emotionally bonding them, there seems to be a neutral. Whether it is the neutrality out of rationality is the question. They do not behave with each other as brothers, carried away by emotions, but they also do not look at each other as enemies because of their earlier experiences in the homeland. Looking at the vast change which has taken place during the journey, it is clear that the experiences of the journey have brought in significant changes in the way one looked at the other. As mentioned in the earlier chapter, the narrator in the beginning describes that they had looked upon each other as strangers, even enemies, dangerous to the unity of our homeland (Arasanayagam 8). Now the change has taken place to an extent where the same narrator is able to say that they do not look at each other as enemies. A significant change in the way they perceive each other. But, in spite of this vast change, they remain neutral. This is a hint indicating that the way they have learned to perceive each other is not out of instant emotions or not even prejudice; there is something more than that, something that is a result of realisation, a realisation which is the result of rational thinking.

The second important question the lines quoted above come up with is whether there is really a medium needed, a common language, a common interest, a shared culture, a relevant history for two individuals to live the moment. Able to learn about survival even without a shared language is an indication that all that matters is that the being of human. The basic needs, through the human instinct, are able to provide a way to maintain a healthy relationship between these individuals. It indicates the basic realisation that each other is a human being, who is depending on each other for the basic needs. Looking at the motivation with which the migrants move on in the journey in order to reach their dreamlands is surprising. Despite the wide media coverage of the failed attempts of such journeys and the detailed descriptions of such sufferings, the motivations to take up these journeys continue.

While closely reading the survival throughout the journey described in the story, it is clear that it was not just a matter of depending on each other for safety and security, but the journey's circumstances have taken them all the way up to depend on each other for the basic human needs. This, indeed, would have been a contributing factor in enabling the people belonging to the different ethnic groups (Tamil and Sinhala) to realise that they need each other for the survival. In a journey where own identities are being lost, the dependence on each other for the survival would have been an important element in enabling a healthy relationship within the people of this diasporic migrants.

V. CONCLUSION

In terms of survival, the journey has indeed taken the migrants, especially the narrator to the bottom levels of survival where treating each other as fellow human beings with the similar basic needs and depending on each other for the same needs has taken down the prejudices and has provided an opportunity to learn to trust each other. It was not the same back at home. The need to survive in the journey while depending on each other has made the ethnic relationship of these individuals strengthened. It was also a way for them to learn when it comes to the basic human instinct, we are all the same and we are people who need to co-exist together depending on each other's providence and help. Even though the set up and the environment is different in the host-land, the journey has indeed influenced the way each perceived the other ethnicity and has the hope of influencing the future of the relationships of these ethnic groups in the host-land. It was interesting to notice that the person, who had the need to achieve the highest level of perfection through the enlightenment by taking up this journey, was brought down to the basic levels of needs where the humanness had to be realised.

VI. WORKS CITED


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Eastern Africa Standby Force’s Efforts In Execution Of Its Mandate In Maintaining Peace And Security In Kenya And Somalia

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Abstract- The nature and numbers of intrastate conflicts in the early nineties challenged regional security; thereby requiring a collective regional response. This explains the formation of a number of regional security mechanisms such as EASF with a mandate to maintain peace and security in the Eastern Africa region. Despite over a decade of its existence, the EASF efforts to tackle the seemingly intractable peace and security dilemmas in the region and especially in Kenya and Somalia have remained elusive and insignificant, making it more of a bystander. This study sought to address this gap. As for EASF efforts to enhance its capability to be able to maintain peace and security, the study found out that EASF has put in place a number of initiatives. The study therefore sought to evaluate Eastern Africa Standby Force’s efforts in maintaining peace and security in Kenya and Somalia. This research paper is underpinned by theoretical framework utilizing power theory.

I. INTRODUCTION

Globally, at the beginning of the Cold War, the United States and its European allies created a security organization that sought to deter the Soviet Union from further expanding beyond East Berlin. In 1949, the North Atlantic Treaty Organization (NATO) was formed and it served as the premier world security organization. The United States has been a central member of NATO with its role enhanced since the end of the Cold War. In recent conflicts, the United States has been involved in NATO military operations, particularly in Eastern Europe, South Asia, and North Africa. Lindberg (1963), noted that international actors that seek to attain their interests will require “systematic and durable cooperation” and institutions will seek “to attain their ends, including increasing their shares of gains from cooperation, through the use of political influence.” Continentally, the ASF as a multidimensional force was formed to ensure continental stability. Since most conflicts on the continent are complex and of long duration, they call for a multifaceted approach and require capabilities to address not only security and military aspects, but also the political, humanitarian, developmental and legal/institutional dimensions of the conflicts. According to Darkwa (2017), the African Union came to life in July 2002. Nzau (2016), observes that the other effort by EASF in its mandate of maintaining peace and security in Kenya and Somalia is through cooperation with IGAD. It was founded in 1996 to replace Inter-Governmental Authority on Development and Desertification (IGADD).

II. THEORETICAL FRAMEWORK

The study was underpinned by power theory. The theory was advanced by Morgenthau (1960), who emphasized on the importance of “the national interest” in politics among nations. He wrote “the main signpost that helps political realism to find its way through the landscape of international politics is the concept of interest defined in terms of power”. It underscores the fact that individual states are able to invoke their domestic power to maintain peace and security within their territory. Additionally, Waltz (1986), observes that power is a key concept in realist theories of international politics, while conceding that 'its proper definition remains a matter of controversy.' While Gilpin (1981), describes the concept of power as 'one of the most troublesome in the field of international conflict' and moots that the 'number and variety of definitions should be an embarrassment to political scientists', there is however a widespread consensus among international conflict scholars on both the necessity of addressing the role of power in international interactions and the unsatisfactory state of knowledge about this trope-power (Guzzini, 2000; Barnett and Duvall, 2005; Berenskoetter and Williams, 2007). The power theory explains exertion of influence of one party, EASF, and therefore the efforts of group or individuals over another.

III. RESEARCH METHODOLOGY

This study adopted descriptive research design. Orodho (2003), defines descriptive design as a method of collecting information by interviewing or administering questionnaire to a sample population to get their attitude, opinion and habits on any variety of educational or social issues. This design was used to describe the demographic elements under study. It gave a detailed account of demographic characteristics of the respondents to the study. The descriptive approach aided in describing the status of the variables in objective one while showing how the variables relate in the natural setting (Creswell, 2009). The design was used to describe a compendium of efforts made towards EASF’s mandate of maintaining peace and security in Kenya and Somalia. A total of 300 questionnaires were administered to the
respondents. 255 were returned, while 45 were not returned. This implied that there was 85% response rate. This impressive rate was achieved due to the rigorous engagement of the respondents by the research assistants. The 15% who did not manage to complete the study was either due to busy schedules or failure to submit the questionnaires in time. The study findings are considered valid since, according to Mugenda and Mugenda (2003), a response rate of 50% is adequate for analysis and reporting. A response rate of 60-69% is considered to be good, while that of above 70% is excellent. So the response rate for this study was excellent (Mugenda and Mugenda, 2003).

IV. STUDY FINDINGS

❖ Strengthening of EASF Funding Support

The study sought to find out if improving the financial support of EASF was an initiative used by EASF to enhance its capability of maintaining peace and security in Kenya and Somalia. Out of the 255 respondents, 204 (80%) strongly agreed and 26 (10%) agreed. On the other hand 18 (7%) of the participants disagreed and 7 (3%) strongly disagreed. Cumulatively 80% of the respondents agreed that strengthening the financial support of EASF was an effective effort to enhance EASF effectiveness in maintaining peace and security in Kenya and Somalia.

The results are as illustrated in figure 5.1.

One interviewee had this to say:

Funding for EASF operations remains still one of the key challenges facing the organization. If it is on the annual financial contribution, it is based on the GDP of the countries. While Kenya pays over 800 million USD per year, Uganda pays between 400 and 500 million USD while other EASF member states pay even less. This support is not sustainable. EASF has initiated efforts to establish a predictable funding mechanism through securing contributions from international partners like the UN, grants from bilateral sources and the AU to be used to establish the EASF peace fund. The efforts are at different levels of success. (Interview with Key informant, on 20/11/19, Nairobi EASF Headquarters).

The foregoing findings were supported by Bayeh (2014), who argues that, reliable funding is a pre-requisite for effective maintenance of peace and security not only in Kenya and Somalia by the EASF but also in Africa by the ASF. This is reinforced by the fact that successful peace operations and capacity building measures require adequate financing. Lack of funds for ASF in the past had created a problem of dependence on external support. This undermined local ownership of the Force and as a result called into question the role of the ASF as an “African solution to African problems” (Bayeh, 2014).

Munene (2010), observed that in the EASF region, member states had over the years remitted annual contribution to support peace and security initiatives in the region. This was however never adequate, due to their weak internal funding capacities and occurrence of donor fatigue. This in return rendered member states to refrain from actively committing their forces to the regional mechanism for operational deployment due to the mere reason that there were no sufficient funds to reimburse them costs they had incurred in such operations. This therefore affected the ability of EASF to address security challenges not only in Kenya and Somalia, but even elsewhere. The assertions had been
echoed by Allehone (2008), who averred that this kind of scenario discouraged contributions from especially states with less financial capacity, thereby undermining the EASF’s multinational effort towards peace and security in the region (Munene, 2015).

One of the initiatives that EASF is employing to overcome this funding challenge was to establish a predictable financial mechanism by establishing a peace fund. The EASF peace fund was established in 2014, through an agreement signed by all the members of EASF. They pledged to establish the EASF peace fund.

By 2015, the EASF fund had received support amounting to $8.7m from member states, while donors had contributed $2.6m. This amount was only capable of supporting deployment for 90 days. EASF was however expected to be able to finance a deployment of at least six months, which would be difficult with the current budget. The Fund continues to generate contributions from a variety of sources. They include 12% of the annual budget, voluntary contributions, and external sources such as the EU’s African Peace Facility (Tlalka, 2014).

After operationalization of the fund, EASF was then able to authorize its members to provide for the self-sustainment of their forces for timeframes that vary from 30 days to 90 days for deployment of their standby capabilities in regionally mandated/approved missions. EASF would later use the peace fund to reimburse expenditures incurred by the Troop and Police Contributing Countries (T/PCCs) using the peace fund. EASF would thereafter proceed to finance the mission from the predictable funding instrument. Through the Fund, EASF has managed to secure more predictable and sustainable funding for PSOs and related activities in its endeavour, especially to maintain peace and security in Kenya and Somalia (Tlalka, 2014).

The initiative by EASF to set up a peace fund was motivated by a similar mechanism developed by ECOWAS. Darkwa (2017), observed that a verification of ASF operational readiness that was conducted by AU in 2013 found that other regions had adopted similar mechanisms. In 2013, the AU Chairperson constituted a panel of experts to assess the operational readiness of the African Standby Force. The team was led by Prof Gambari. Among the issues to be assessed was the status of funding capability of the REC/RMs. Their report revealed that ECOWAS had already managed to develop a peace fund, which had enabled it to effectively conduct its peace and security activities in West Africa. The region had applied a Community Levy approach, wherein the Commission makes in its annual budget a provision to fund Peace Support Operations through an ECOWAS Peace Fund. The levy is a tax percentage of goods being imported into the region at the rate of 0.5 % of the customs value of the goods. A percentage of the Levy was earmarked for Peace and security operations and kept in the ECOWAS Peace Fund (Darkwa, 2017).

Darkwa (2017) ascertains that the mechanism enabled ECOWAS to also generate finances from donor forums conducted regularly to sensitize partners on the fund and provide overview on its modalities. The idea to start the fund was established after ECOWAS deployed in peace and security scenarios in Liberia, Sierra Leone, Guinea Bissau and Mali in the 1990s and had serious financial challenges to reimburse the participating countries. The situation was made dire by the fact that, despite the operations being mandated by the AU, reimbursements to the REC by the continental body were not forthcoming in time. This became a huge source of frustration to the ECOWAS, especially in the face of consistent demands for reimbursements from the concerned Member States. This informed their decision to set up a peace fund, which has henceforth provided sustainable mechanism to ECOWAS operations (Darkwa, 2017).

Use of Diplomatic Missions

The study sought to find out if use of diplomatic missions by EASF would enhance its efforts of maintaining peace and security in Kenya and Somalia. Out of the 255 respondents, 120 (47%) of them strongly agreed, 58 (22%), agreed, while 32 (12.5%) and 45 (17.5%) disagreed and strongly disagreed respectively.

Cumulatively, 70% supported that the effort would enhance EASF effectiveness in maintaining peace and security in Kenya and Somalia. The results are as shown in figure 5.2.
One respondent had this to say:

EASF has a military heavy structure. The concept of military diplomacy therefore, applies in its operations in Kenya and Somalia. The EASF has not adequately employed intensive diplomatic initiatives and missions to address the peace and security concerns in Kenya and Somalia. It has instead cooperated and coordinated its diplomatic efforts with other regional actors and organizations like IGAD and EAC. (Interview with Key informant on 20/12/19, Mogadishu military camp)

The findings are supported by previous study conducted by Migue (2014), which revealed that the concept of military diplomacy was more contextualized within the realm of state defence diplomacy, and less within the wider framework of regional diplomacy. From the foregoing, it does seem logical to argue that military diplomacy is to be seen within the confines of the traditional practice of diplomacy by states. And the question that does arise is, “Does the military conduct diplomacy?” In answering this question one is bound to bring to the fore the peculiar characteristics that define military diplomacy and distinguishes it from the traditional diplomacy alluded to earlier (Migue, 2014).

One may also want to understand how military diplomacy has evolved over the years. Military diplomacy gains relevance considering that diplomacy has experienced a significant transformation particularly in the last decades of the 20th century. Specific reference has been made to the erosion of the barrier of sovereignty, by globalization, revolution in communication and infrastructure, which has cushioned states against interference in their internal affairs by other states and non-state actors. Sovereignty may be the single most vital attribute of the state security. The configuration of the present state system is credited to the 1648 Treaty of Westphalia. The attendant acquisition of sovereignty among states meant that these new units of political organization were equal with no overarching supreme authority to superintend over their relations with each other. In spite of their “equality” however, their relations have been characterized by competing self-interests resulting in what has been called the anarchical international state system (Williams, 2012).

The potential for conflict is therefore, forever present in the international system due to the lack of a common authority. Indeed the main thrust of a state’s relations with another is to influence these relations for its own maximum leverage. It is within this influencing that diplomacy gains credence in what Barston (1995), calls, the statecraft of force. This entails such actions as preventing aggression, building alliances, threatening or cautioning an enemy and soliciting for international support for legitimacy and use or control of force. States over time came to the realization that persuasion was critical in their relations. Indeed states became aware that persuasion was usually more successful than the actual use of force. However, the use of the carrot and stick became a useful strategy in determining interstate relations. It is not uncommon therefore, to find the employment of military force to give “muscle” to negotiations (Souza, 2013).

Diplomacy and military force have been used by states and regional security mechanisms for ages and can be seen as the traditional instrument of foreign policy. Used this way, diplomacy is combined with other instruments besides the military to include economics and subversion in what has been labeled as “mixed” diplomacy. In this regard, diplomacy is a communication channel through which the use of threat to use other instruments is relayed to other parties (Robinson, 2014).

One important aspect as regards the EASF was the realization that problems in Kenya of Somalia were not essentially military problems but was also political. As advocated by the deputy chair of the AU, Mr Erastus Mwencha in 2014, these problems therefore, required a mixed approach owing to their complexity. They required a more heavy diplomatic approach, than military. For this reason EASF required to deploy its
diplomatic initiatives and missions to address peace and security concerns in the two countries; and where there were gaps, EASF was to continue cooperating and coordinating diplomatic missions with other sub-regional organizations like IGAD and EAC.

Deployment of Peace Support Missions

This study sought to find out whether deployment of peace support missions would enhance EASF efforts of maintaining peace and security in Kenya and Somalia. From the findings, out of the 255 respondents, 65 (26%) strongly agreed, 78 (31%) agreed, 29 (11%) disagreed and 83 (32%) strongly disagreed.

Cumulatively, 57% concurred that this activity would enhance maintenance of peace and security in Kenya and Somalia. The results are illustrated in figure 5.3.

One respondent from AMISOM underscored the following:

EASF has been engaged in the PSO activities in Somalia but not in Kenya. This is however in the context of the African Union Mission in Somalia. EASF has deployed a 231 police component to AMISOM that was largely composed of East African countries’ troops. Albeit small, the EASF police mission is significant in the development of the police dimension of the ASF. EASF has been also incorporated as part of United Nation Political Office for Somalia (UNPOS) and United Nations Support Office for AMISOM (UNSOA). Additionally, on the request of the African Union, EASF carried out a fact-finding mission in Somalia (Interview with Key informant, Date 20/12/19, AMISOM HQs, Mogadishu.)

The finding is supported by Aboagye (2012), in his book titled, "A Stitch in Time would have saved nine. Operationalizing the African Standby Force", who underscores the important roles undertaken by peace support missions when deployed in conflict situations. Key among them is the protection of civilians from sexual violence and other vices during armed conflict. They also provide conducive environment for humanitarian agencies to operate and support victims of the conflict. They undertake disarmament; demobilization, reintegration and rehabilitation (DDRR) programs to ensure combatants in a conflict are provided with long-term support. They work with other agencies to provide health care and counselling services for victims of conflict-related sexual violence who are eligible for the DDR programmes. They also assist in the establishment of a secure and peaceful environment for the holding of free, transparent and inclusive elections. To ensure future sustainability they work with other specialized agencies to conduct Security Sector Reforms that ensure new Security Sector mechanisms are put in place to provide Justice and Rule of Law through accountability in conflict situations (Aboagye, 2012).

EASF is fortunate to have members like Kenya that have a long-standing experience in peacekeeping operations and that are capable of contributing immensely to EASF peace support missions to maintain peace and security in Kenya and Somalia. Shah (2009), in his book titled “Conflicts in Africa”, observes that the situation between Kenya and Somalia has always been contentious due the latter’s policy of irredentism and the occasional incursions of its troops into the Northern Province of Kenya, which is predominantly inhabited by a Somali ethnic population. Tensions between Kenya and Somalia, over the Somali inhabited region occurred right after the independence of Somalia in July 1960. The first Somali independent state declared its intention to unify the Somalia inhabited regions in the horn of Africa under one state in which north eastern province of Kenya was included. Northern Frontier Liberation Army (NFLA), an ethnic Somalia secessionist movement, was established in the early 1960s to fight against Kenyan rule in this region. The Somali government at the time backed up this movement and provided them moral and material support. However in spite of history,
Kenya has always been friendly with the Somali people since the war broke out in Somalia in 1991. Kenya accommodated the largest number of Somalia refugees who fled the war in Somalia (Shah, 2009).

According to UNHCR Report (2012), Kenya hosted about a half a million Somalia refugees in 2012, but had reduced to two hundred thousand in 2019 due to UNHCR assisted repatriations thereafter. The fact that all conflicts affect regional countries in several ways, the scale of Somali refugees in Kenya could hugely affect this country in variable aspects. This is exemplified by Brown (1996), where in his concept on regional dimensions in internal conflicts, he explains that refugee is a result of internal conflict and it mostly affects the neighboring countries.

Even though Kenya hosts the largest number of Somali refugees in the world, Kenya’s role in the Somali conflict remained quite neutral for many years. Kenya has been involved in mediation processes between Somalia internal actors and has hosted several peace processes meant to reconcile conflicting parts in that country. This includes the one that was held from 2002-2004 in Mbagathi Conference Centre, Nairobi in Kenya under the auspices of IGAD member states and the international community supporting the Transitional Federal Government (TFG) of Somalia. Regardless of its role in the conflict, Kenya always experienced insecurity incidents posed by this conflict since it broke out in 1991 (Wise, 2011).

The relations between Kenya and Somalia worsened from 2006, due to the changing dimensions of Somalia’s conflict. During this time Al-Shabaab armed groups, who controlled larger areas in Somalia threatened to destabilize Kenya. The terrorist organization carried out several attacks inside Kenya targeting tourism and other economic sources of the country. Moreover, the group started to recruit youngsters of Kenya, Somalis in Kenya and other Muslim nationals inside Kenya to join them. The Kenyan government perceived this as a serious security threat against its national security and interest. Recruitment of youngsters provided the terrorist organization a capacity to destabilize Kenya through home grown elements. Consequently, the Kenyan government changed its behavior towards the Somali conflict by sending the Kenyan defense forces (KDF) into Somalia to fight Al-Shabaab and prevent their attacks against Kenya. In relation to the dimensions and the behavior of the actors in the Somalia conflict, the conflict can be classified as what Kaldor (2012), explained to be new wars. Recruitment of young men of different nationalities by Al-Shabaab and involvement of Al-Qaeda terrorists indicated a new war character in this conflict (Kaldor, 2012).

It is against this background that KDF’s military deployment in Operation Linda Nchi (2011-2012) against terrorist agents in Somalia is to be contextualized. It is understood that, Kenya joined the community of nations on attaining independence on 12th December 1963 and has a rich history in the field of peace support operations. On 16th December 1963, Kenya became a member of the UN and since then, Kenya has been committed to supporting UN peace initiatives all over the world. Peace Support Operations (PSOs) within the KDF can be traced back to 1973 when the UN requested the Republic of Kenya to contribute forces for peace operations in the Middle East after the Israel–Arab war. However, in spite of Kenya acceding to the request, KDF troops were not deployed due to various logistical constraints. Later within the same decade, KDF started participation in UN PSOs in a career spanning twenty-six missions in sixteen different countries in Africa, the Middle East, the Balkans and in Asia in a period covering over thirty years (Migue, 2014).


This study also proffers that the events leading to the deployment of KDF into Somalia constitute defense diplomacy while KDF’s military engagement in Somalia in the period under review constitute military diplomacy. In response to the challenges affecting the national security and interest, the Kenya government increased its involvement in Somalia by integrating the Kenyan forces in Somalia with the AMISOM peacekeeping forces operating under the mandate of the AU and UNSC. The Kenyan forces operating in Somalia initially invaded Somalia with an individual self-defense decision by the Kenya government under Article 51 of the UN Charter. The AU and UNSC officially allowed KDF to join AMISOM peacekeeping forces through in UNSC resolution 2036 of February 2012. The resolution provides legal framework, mandates and resources to the Kenyan forces to fight Al-Shabaab in Somalia (Migue, 2014).

In order to protect its own national security, Kenya strives for peace and stability in Somalia, particularly in the nearby regions of Juba land. Therefore, in order to get security in her territories, an active Somali regional state in the nearby regions is an option for Kenya in the context of Jubaland. This friendly region creates a security buffer zone to protect Kenyan national security and interest. Moreover, Kenya argues that such an authority can create a safe and secure environment for Somalia refugees living in Kenya to return and resettle in their country (Erickson, 2013).
Even though Somalia’s conflict has prolonged and passed through different dimensions and multiple identities, the intervention by neighboring states such as Kenya and Ethiopia can lead the conflict to a new dimension with new identities based on regional states. The behavior of Kenya in this conflict is unlikely to produce a holistic solution for Somalia’s conflict; it rather focuses on a partial solution in which its national interest is bounded. Even though, Kenya explained this is an action of defensive intervention which, Williams (2018), explains to be when states intervene others’ conflicts with the objectives of self-defense and target to bring cross-border problems, such as refugee flows or military assaults to an end, to keep wars from spreading or more ambitiously, to bring wars to an end (Williams, 2018).

As highlighted by the respondents, the EASF has so far made some efforts to deploy a peace support mission in Somalia but to a limited extent, in the context of the African Union Mission in Somalia (AMISOM). In 2011, the EASF deployed a 231 police component to AMISOM, though it was composed not only of East African countries’ troops. Albeit small, the EASF police mission was significant in the development of the police dimension of the ASF. What is more, the EASF was also later incorporated as a part of United Nation Political Office for Somalia (UNPOS) and United Nations Support Office for AMISOM (UNSOA). Additionally, on the request of the African Union, EASF carried out a fact-finding mission in Somalia in 2011. These are encouraging steps toward EASF efforts of maintaining peace and security in Kenya and Somalia (Abdow, 2012).

Enhancing Mediation Capability

It has been observed throughout Africa, that traditions have since time immemorial emphasized on harmony or togetherness over individual interests and humanness. This was expressed in terms such as Ubuntu (meaning humanity in Bantu Nguni language) in South Africa and Utu (meaning humanity in Swahili language) in East Africa. Such values have contributed to social harmony in intercine African societies and have been innovatively incorporated into formal justice systems in the resolution of conflicts. In this way conflicts have been averted and where they have arisen, there have been mechanisms and institutions that have been put in place to effectively resolve them through mediation without resorting to fighting.

It is against this background that the study sought to find out if enhanced EASF mediation capability would contribute to its efforts to maintain peace and security in Kenya and Somalia.

As illustrated in figure 5.4, out of the 255 respondents, 77 (30%) of the respondents strongly agreed that this would help a lot, 51 (20%) agreed that this would help, 99 (39%) disagreed and 28 (11%) strongly disagreed. Cumulatively therefore, 50% agreed that enhanced EASF mediation capability would contribute immensely to EASF efforts of maintaining peace and security in Kenya and Somalia.

![Figure 5.4: Enhancing Mediation Capability](source: Field Data, 2019)

The findings are collaborated by Abdow (2010), in his book titled “The factors that influence the extent to which community leaders play their role in conflict resolution”. He argues that traditional conflict resolution mechanisms like the adjudication and cross-examination processes among the Yoruba in Nigeria were employed whenever intercommunal differences arose. This was because they offered great prospects for peaceful co-existence. It was therefore, imperative that traditional conflict management mechanisms were harnessed to manage conflicts, as they were more of resolution mechanisms rather than settlement initiatives, in the wider context of mediation (Abdow, 2010).

He argues that African societies have used mediation processes to resolve conflicts for hundreds of years. It was used informally where disputants could just sit with a third party such
as the council of elders who could facilitate the mediations. However, the formal legal system has failed to recognize that mediation is not a new concept and has tried to classify mediation as part of the Alternative Dispute Resolution mechanisms. It views mediation as an alternative to litigation. This view of mediation is flawed as it gives mediation a second place in the conflict settlement continuum. Mediation can stand alone as a method of resolving conflicts. Care has to however be taken to ensure that parties enter into mediation voluntarily. With this the outcome of the process is respected and the solutions reached are acceptable and enduring to all parties to the conflict (Abdow, 2010).

Menkhaus (2005), while alluding to protracted conflict in Somalia, acknowledges that mediation processes, if carried out correctly leads to outcomes that are desirable to all parties and are enduring. This is because parties have autonomy over the process and the outcome. Parties who have a conflict may decide to negotiate. When negotiations hit a deadlock they get a third party to help them continue with the mediation. The mediator’s role in such a process is to assist the parties to keep engaging, throughout. He or she does not dictate the outcomes of the mediation. Parties must have the autonomy of the process and of the outcome since it is a voluntary process. When the voluntariness is lost then the process of mediation is negatively affected. The parties are expected to report back the outcome of their mediation to court for it to endorse it. It is however important to ensure that the process is not exposed to the vagaries that bedevil the court system including delays, bureaucracy and inefficiency (Abdow, 2010).

The concept of utilizing mediation as a mechanism to resolve conflicts was adopted by EASF, as one of its key conflict resolution initiatives at its establishment. Conflict situations were in the region were initially being addressed by the West, but following the end of the Cold War, the West became disinterested and attached many conditions before being involved in any conflict in Africa. A combination of factors explains this attitude. The main one was the death of 18 USA marines in Mogadishu and the chaos that engulfed the Balkans in the 1990s, diverting Western attention. This neglect manifested itself in the lack of intervention in the Rwandan genocide, Liberia and Sierra Leone in the 1990s. It is this situation that saw intervention by ECOWAS in Liberia, which set a precedent for sub-regional interventions (Agaypong, 2005).

This led the debate on sub-regional intervention. The debate was dominated by two contradicting views. Whereas Nye (2011), in his book titled, "The Future of Power", supports the approach, to use regional organizations to resolve regional conflicts, others argued on the contrary. He further contended that sub-regional organizations were better placed because they were nearer to the conflict and could afford to stay long after an agreement to stabilize the situation has been signed. Equally, sub-regional organizations have the advantage of understanding the conflict better and had relationships with the parties to the conflict. Those who contended this view however, argue out that sub-regional organizations lack the resources and capacity for intervention (Nye, 2011).

The opposing side of the debates argued that because of their proximity to the conflict such organizations were entangled with the conflict to the extent that, they lacked the legitimacy that an international intervention would have.

IGAD’s intervention in Somalia in 2005, when viewed from this perspective had the advantage of an in-depth knowledge of the conflict and relationship with the parties to the conflict. But it also had serious shortcomings; with the main one being lack of resources. To overcome this problem, IGAD partnered with the International Partner Forum (IPF), comprising of a consortium of countries willing to provide resources towards the resolution of the Somali conflict responsibility to sub-regional organizations (Williams, 2011).

However, throughout the debate, mediation has been accepted as an important aspect of not only resolving conflict but also for peace building. If properly utilized, it could achieve not just a settlement of conflict but facilitate a full transformation of relations. If peace building is defined as identifying and supporting those structures that can strengthen and solidify peace in the aftermath of peacemaking and peacekeeping, then peace building encompasses a range of activities and structures before, during and after formal peace agreements between parties are signed. It is also therefore a dynamic process of resolving conflict and rebuilding societies involving mechanisms and structures that can prevent, terminate, transform or resolve conflict. It further involves mechanisms and structures that can strengthen the capacity of a society to manage change without violence. This may involve addressing the root causes of conflict through long-term economic and social provisions as well as policies of reconciliation. There is a growing recognition of the potential of mediation outside its traditional role in conflict resolution (Vines, 2013).

Souza (2013), observes that the Organization for Economic Cooperation and Development (OECD), which is a group of 34 member countries that support free-market economies in the world also encourages mediation as a way of strengthening the resilience capacity of states and state-society relations. Important elements include supporting dialogue processes between civil society, the private sector and state institutions. Mediation initiatives have also strengthened private sector investment in Bosnia and Herzegovina. Between 2004 and 2006, local mediators resolved disputes between companies and thereby facilitated the release of €8 million in private-sector investments (Vines, 2013).

Robinson (2014), further observes that examples abide on the potential gains of mediation support activities for economic development. He reckons that the value added of current mediation practice provides important insights into strengthening political accords and economic conditions in war-to-peace transitions. For this reason, defining a role for development agencies as strategic partners for peacemaking is therefore an important element to managing the transition from war to peace. Their engagement during peace process helps create a new vision of the economy and society that convinces parties that it is worthwhile to stop fighting. If a future without armed conflict becomes a more viable reality, the parties to a peace process may increase their commitment in negotiations as companies commit to post-conflict economies before the signature of a peace agreement. In addition, development actors can marshal important
financial flows into conflict countries that could be used as incentives for peace, an arrangement used by EASF in Kenya and Somalia (Robinson, 2014).

Bouka (2016), in his book titled,” Missing the Target: The African Union’s Mediating Efforts in Burundi” observed that since conflict is dynamic and unavoidable in the East African region, EASF has been involved in a number of conflict mediation interventions, albeit few. He underscores the role-played by EASF in mediating the 2015 Burundi crisis. This was after late president Nkurunziza decided to run for a controversial third term in office. EASF was supposed to deploy in Burundi as part of the African Prevention and Protection Mission in Burundi (MAPROBU). However, in December 2015, three members of the AU PSC, that were also members of the EASF, namely Uganda, Ethiopia and Burundi became very instrumental in undertaking mediation initiatives among the opposing parties in Burundi. The mediation efforts team was headed by the defence minister of Uganda, Mr Kiyonga. This contributed to easing of tensions in the country (Bouka, 2016).

EASF has played significant roles in offering mediation forums for Somalia during its long period of instability and also in Kenya, especially during the 2007/2008 Kenya’s post-election violence (PEV). In 2019, EASF was also working closely with IGAD, whose chair, the Prime Minister (PM) of Ethiopia, Dr Abiy, was leading mediation efforts between Kenya and Somalia to resolve the maritime dispute between them. Though the case still remains at the International Court of Justice (ICJ), such regional mediation efforts were taking place to resolve the issue amicably. EASF has also partnered with other regional organizations like IGAD and ICGLR to promote peace and security in Eastern Africa region through various mediations efforts. These EASF mediation efforts especially in Kenya and Somalia have made things much better because prior to the end of the Cold War, interventions in Africa and especially in the Eastern Africa Region, were determined by allies, either from the Eastern bloc, led by the Soviet Union, or Western bloc led by the USA (Derroso, 2010).

Munene (2015), in his book titled “A Look at the East Africa Standby Force”, observes that EASF has attempted to unearth dozens of underlying factors that contribute, as well aggravate Kenya–Somalia relations through a number of mediation efforts. By and large, this effort has assisted to address the issue of refugee flows, humanitarian crises, arms cross border flows and Islamist terror attacks that have strained and compounded the Kenya-Somalia peace quest.

This supports the finding that an enhanced EASF mediation capability will therefore greatly improve EASF efforts to maintain peace and security in the region and especially in Kenya and Somalia (Munene, 2015).

V. CONCLUSION

The study concludes that, despite positive efforts by EASF to promote its capacity to maintain peace and Security in Kenya and Somalia, collaborative efforts with other actors have been lukewarm and lacking in synergy. Therefore EASF, like other regional security mechanisms has a responsibility to seek and coalesce with other mechanisms under APSA in order to realize its full mandate potential.

VI. RECOMMENDATION

The study recommends EASF establish a real-time monitoring and accountability framework that should aid it in fast tracking the initiatives put in place for fostering peace and promoting security in Kenya and Somalia. This involves putting in place multi-pronged efforts to dissemble the impeding factors towards peace and security in Kenya and Somalia.

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Increasing the uptake of Green Buildings—Insights from the Case study of an Apartment in Sri Lanka

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Abstract- Sri Lanka has an immense potential for renewable energy given its location near to the equator. Colombo, and a large part of the Western Province, experiences 2620 hours of annual sunlight (approximately 7 hours every day). Furthermore, being a seaside island, it also experiences a fair amount of strong sea breeze on both the west and the east coast. Thus, Green buildings, leveraging renewable energies, have a huge prospect in Sri Lanka. In the long term, green buildings have a deep economic benefit, with lower energy footprint and hence low costs. Moreover, there is a positive environmental and social impact as well, with people becoming more aware of the advantages of being environment friendly. At the time of writing of this paper, Sri Lanka has 61 green buildings, out of which 30 are labelled (officially certified by the Sri Lankan Green Building Council). Despite these benefits, there seems to be a need to increase the uptake of green buildings in the country. The aim of this paper is to research and analyze the benefits and challenges in increasing the uptake of Green Buildings in Sri Lanka. This will be done by investigating the regulatory & fiscal incentives, and economic and social benefits for/of the Green Building movement. The benefits and incentives will be compared with that of standard non green buildings. The paper will also analyze the challenges in terms of the capital requirements, cost of capital, capacity and the intent of the buyers/investors to pay for the premium required for green buildings. Apart from the analysis on Green buildings, the paper also analyzes the long-term energy roadmap of Sri Lanka and the role which renewable energy can play in securing Sri Lanka’s energy security.

Index Terms- Green Buildings, Sustainability, Renewable energy, Energy Efficiency

I. INTRODUCTION

The Green Building movement has the major potential to combat climate change by reducing CO₂ emissions enabled by a more efficient use of energy 1. The paper aims at presenting the tailwind factors of Energy Efficiency, Reduction in Water Usage, Improvement in Indoor Air Quality and Emotional Wellbeing & the challenges related to the uptake of Green Building movement in Sri Lanka. The paper also analyzes the long-term energy roadmap of Sri Lanka and the role which renewable energy can play in securing Sri Lanka’s energy security. Sri Lanka is blessed with a moderate climate and medium population density. Traditionally Sri Lankans have always been living in harmony with nature and even today ~81% of the population lives in villages – outside the municipal corporation/body areas 2. Majority of the households in the rural areas are low rise buildings with tiled roofs and large bay windows, which make them efficient in terms of energy management. While some of the residential buildings have started to have sustainability features like Solar Roof, Water Recycling and harvesting, green spaces and green roof etc, very few buildings are certified Green Buildings. Waidyasekara and Sandamali (2012) state that there is very insignificant uptake of Green Building practices and there are many challenges to achieve the sustainability goal of Sri Lanka. 3 There are only 61 certified buildings under GREENSL Rating (GBCSL, 2020). Given this background the paper will be structured as follows – The first section will present the salient features of and the governance framework for Green Building (GB) & Sustainable Energy (SE) and the current rating system for GB in Sri Lanka. This is followed by a case study of a residential apartment building that received a high GB & SE rating. The case study involves analysis and presenting of the factors that helped the building get benefits and the GB rating. The paper concludes with recommendations for increasing the uptake of GB & SE in Sri Lanka.

II. PUBLIC POLICY ON SUSTAINABLE ENERGY AND GREEN BUILDINGS IN SRI LANKA

Sri Lanka Sustainable Energy Authority is the governing body responsible for pioneering the sustainable energy revolution in Sri Lanka, aiming to facilitate the development of Sri Lanka’s rich energy resources, including solar, wind, water and bioenergy. 4 As per the Sri Lanka Sustainable Energy Authority 4 “Sri Lanka is endowed with several types of renewable energy resources, including biomass, hydropower, solar and wind. Sri Lanka aspires to become a carbon neutral country by 2050 by making the most out of the energy available and developing cleaner energy resources according to the National Energy Policy and Strategies of Sri Lanka”.

With such high aspirations on achieving carbon neutrality the Govt of Sri Lanka has drafted an “Energy Efficient Building Code -2020” 5 and a Guideline for Sustainable Energy residences 6 in Sri Lanka. The draft building code 5 is aimed at ”encouraging energy efficient design or retrofit of commercial buildings, industrial facilities excluding the process energy use and large scale housing developments, so that they may be designed, constructed, operated, and maintained in a manner that reduces the
use of energy without constraining the building function, comfort, health, or productivity of the occupants and with appropriate regard for economic considerations”.

The guideline for sustainable energy residences 6 focusses on presenting a roadmap for sustainable housing elaborating on two aspects in the pursuit of comfortable housing in the Sri Lankan context: Energy Efficiency and Sustainability. The guideline discusses designing homes avoiding the climatic excess from the unique hot and wet climate of Sri Lanka yet leveraging the climate to improve energy efficiency.

Approximately 42% 7 & 8 of the power generated and consumed in Sri Lanka is dependent on liquid petroleum fuels. “As of 2017, Sri Lanka spent 29.5% of its export earnings on fossil fuel imports. The country’s financial resources therefore are heavily drained out of the country due to high import costs. Thus, veering away from imported energy resources and focusing more on renewable energy resources is deemed an urgent necessity”. 4.

Figure 1 7: Represents Installed capacity in the current power system in Giga Watts and by technology type

I. Salient Features of a Green Building

As per the US Energy Protection Website – “Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high-performance building”. 9

III. THE GOVERNANCE FRAMEWORK AROUND GREEN BUILDINGS IN SRI LANKA

As of 2020, there are 61 Green Buildings and 30 of them are labelled/certified by GBCSL.

GBCSL is a consensus-based not for profit organization with diverse and integrated representation from all sectors of the property, industry and academia. GBCSL was established in 2009 with a joint effort by the professional institutions of architects, engineers, structural engineers, town planners, quantity surveyors, university academics, construction industry leaders, environmentalists and business leaders. 10

Rating System followed by GBCSL

GBCSL has its own rating system GREENSL® Rating System, targeted at promoting high performance, healthy, durable and affordable environmentally sound practices in new and existing buildings. This rating system encourages builders and operators of such buildings to implement sustainable practices that reduce the negative environmental footprint of the buildings over their functional lifetime. The rating system considers the following eight metrics. 10 1) Management (MN) 2) Sustainable Sites (SS) 3) Energy and Atmosphere (EA) 4) Water Efficiency (WE) 5) Materials and Resources (MR) 6) Indoor Environmental Quality (EQ) 7) Innovation and Design Process (ID) 8) Social and Cultural Awareness (SC)

The salient features of the green building and availability of a supporting governance framework with a clear rating system in Sri Lanka there should have been a higher uptake of green buildings in the country. The Clearpoint Residences, a certified green building, in Colombo city is presented as a case study to illustrate the myriad of benefits of adopting such practices. The criteria of the GBCSL rating system provides a broad framework for the case study.

IV. ABOUT CLEARPOINT RESIDENCES – SRI LANKA (REFERRED AS THE GREEN BUILDING IN THE SURVEY RESULTS) 11

Clearpoint is the tallest residential vertical garden in the world, with planted terraces circling the entire structure and an inbuilt self-sustaining watering system. Guided by its cutting-edge yet holistic design approach, the building features several sustainability features that substantially reduce the energy and water consumption of its residents, whilst providing a level of comfort and luxury that is truly in harmony with nature. Some of the key and unique sustainability features of this GBCSL platinum rated Green building are as follows:

1. It has a large Solar Roof which powers the common areas and elevators and sells excess power to the grid.
2. Drip irrigated, planted terraces surrounding every apartment, which not only give a feeling of being connected with nature, but also improves air quality and reduces temperature. (Continued on Page 4)
3. Rainwater harvesting and Grey water recycling, using rainwater and recycled grey water to irrigate terraces and releasing surplus to the nearby water bodies sustaining a complete wet water ecosystem
4. Wedge design improving sunlight and cross ventilation in apartments thus reducing energy footprint
5. Electric charging points for hybrid vehicles
6. Centralized water heating system which is more energy efficient vs each apartment having a individual water heater
7. Solid waste segregation at source and upcycling through relevant agencies
8. Energy efficient elevators with port technology (grouping passengers for a cluster of floors) and regenerative drive technology which also saves energy
9. Smart sensor-based lighting

V. RESEARCH SPECIFIC TO THIS PAPER

A web-based survey pointed towards people perceiving Green Buildings to be better/ more efficient on the following parameters.

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10757
A. Energy Efficiency
B. Water Usage
C. Indoor Environment Quality
D. Emotional Wellbeing and outlook towards sustainability features

Using a web survey app, a questionnaire-based interview was conducted for around 100 residents of CPR and other buildings in Colombo. Experts were reached out in this area using telephonic interviews to understand their views on the subject.

VI. KEY FINDINGS

There is a tangible benefit coming out of the sustainability features specially in the areas of energy on a per resident and per square foot basis. CPR being the only rated Green Building in this survey, had a significantly lower energy footprint (per resident and area) basis vs the other buildings surveyed.

A. Energy Efficiency

There is a very significant difference in the per capita electricity bills paid by the residents of Green Buildings with solar roofing. The average electricity bill per person for Green Buildings is 29% lower than that paid by others. If we look at the average electricity bill paid per square feet, the Green Buildings have a 55% lower outlay vs the others.

B. Water Usage

There is not a big difference in terms of per capita water bills paid by Green building residents vs the others. Green Building residents pay 3.8% less than others. This is even though the Green Building has a water recycling system and the used water is cleaned and reused in toilet flushes. There is a scope to further clean the used water to water the green areas as well. That will require investment in advanced filtration systems, which don't work out economically as the cost of fresh water is very reasonable.

C. Indoor Environment Quality

The indoor environment quality in Green vs other buildings were also measured in terms of daylight efficiency, cross ventilation and impact of planted terraces on indoor temperatures. Using standard temperature gauges, it was found out that the Green Building Homes are cooler by ~2-4 degrees centigrade vs the others. This is because of the cross ventilation and the planted terraces in the Green Building acting as a buffer stopping the sunrays which would have otherwise warmed the homes.

The Green Building has one of the largest residential solar roofs in Sri Lanka; a feature which also keeps the Rooftop terrace cool and helps shading the swimming pool and hence saving on water evaporation.

The incidence of headaches, upper respiratory tract infections, eye irritation and fatigue, were also checked binarily with the respondents. These are typical indicators of poor Air Quality Index (AQI).

The Green Building residents have significantly lower levels of incidence of any of the above physical ramifications of poor AQI; Only 3% of the respondents in Green Building demonstrated these symptoms vs almost 9% in other buildings.

D. Emotional Wellbeing & outlook towards Sustainability features

The residents were also interviewed for understanding their wellness routines, rituals and optimism towards the future. Almost 86% of the Green Building Residents answered “Yes” to a question about the future being better than today; much higher than 57% who answered in affirmative for the same question in the Other Buildings. The timing of the survey with COVID pandemic raging across the world may have impacted the outcome of this question.

There was also a difference in the wellness and communal rituals of buildings with green communal spaces vs those without them. About 68% of Green Building residents confirmed the use of wellness facilities (Green area, Multipurpose Courts, Gym etc) vs 47% in other buildings which had these amenities.

94% of the Green Building residents were aware of the Sustainability features of their building and its benefits; whereas this number was 80% in non-green ones. A staggering 93% of Green Building residents will be ready to pay a premium of average 15% for a Green Building vs a Non-Green one. This number drops to 51% in the non-green buildings.

VII. FISCAL AND REGULATORY INCENTIVES TO PROMOTE GREEN BUILDING AND RENEWABLE ENERGY

Sri Lanka is blessed with abundant sunlight (2620 hours/year), high hydropower, wind energy and biomass potential and aspires to make its power sector carbon neutral by 2050. The country has a very encouraging incentive offered to high end domestic consumers to avoid consumption in higher block tariffs in the domestic tariff system.

Roof Top Solar power is being encouraged by the Government with high subsidies in terms of a buyback arrangement.

Solar service providers have implemented a system which exports the excess solar electricity generated from the domestic solar users to the national grid. In return, the Central Electricity Board (CEB) / Lanka Electricity Company Ltd (LECO) will pay the domestic user for the number of units contributed to the national grid by paying a sum of Rs.22.00 per unit for the first seven years and Rs.15.50 for eight to twenty years. In other words, the consumer gets paid by the CEB / LECO when their solar system generates excess energy and shares the surplus units with the national grid. This payment arrangement is applied for ‘Net Accounting’ and ‘Net Plus’ solar scheme users.

Another incentive for the solar energy consumer is that they do not have to pay electricity bills unless their consumption is more than what is generated on their own roof top. This helps electricity consumers to reduce their bills up to zero and benefit with unlimited electricity usage.

VIII. CHALLENGES IN THE UPTAKE OF GREEN BUILDING MOVEMENT IN SRI LANKA.

While there is a clear return of investment from Green Buildings, there are multiple challenges in terms of their scale up. The fact that very few residential buildings in Sri Lanka are Green rated speaks about the public awareness and demand for such a rating from prospective buyers. Green Buildings require very clearly laid out features and architectural designs, which many a
time are overlooked by builders and buyers for higher Floor Area ratio (ratio between the total plot size and constructed space). While the cost of Photo Voltaic cells is going down and there are substantial incentives \(^{16}\); the total installed capacity for roof top solar is ~ 200 MW and overall solar power contribution to the national power generation capacity is ~5% only. \(^{12}\)

While the CAPEX requirement for solar power has gone down, the cost for other sustainability and green features have remained stagnant along with real estate prices in Sri Lanka, thus making it increasingly difficult for builders to go for a Green rated residential or commercial building.

**IX. CONCLUSION**

The aim of this paper was to present the tailwind factors of Energy Efficiency, Reduction in Water Usage, Improvement in Indoor Air Quality and Emotional Wellbeing & the challenges related to the uptake of Green Building movement in Sri Lanka. The paper also analyzed the long-term energy roadmap of Sri Lanka and the role which renewable energy can play in securing Sri Lanka’s energy security.

From the research done, the following issues emerged:

**A. Awareness:** The concept of Green building and sustainability must be included in the school curriculum to build awareness about this important sustainability concept, in the next generation. Similarly, the public at large must be made aware of environmental, economic and social benefits of Green Buildings.

**B. Encouraging Policy framework around Green Buildings and Sustainability:** While there is a roadmap for Sustainable Finance published by the Central Bank of Sri Lanka\(^ {15}\), as of now there is no concessional cost of capital available for buyers and sellers of Green buildings. There is no tax incentive, other than the subsidy provided on roof top solar power to encourage Green buildings. There is a need for fiscal incentive-based policy-based encouragement for Green rated buildings including developing an accepted Green Building code and retrofitting non green buildings making them Green.

**C. Alignment of stated objectives and long-term plans on Renewable energy:** While the Government of Sri Lanka has announced a goal to reach 80% renewable energy by 2030 \(^ {7}\); currently there is an overdependence on Hydro power which has its own dynamics because of seasonality of rains and climate change. The Ceylon Electricity Board has published a Long-Term Electricity Generation plan (LTGEP) in 2019. \(^ {12}\) This plan outlines the roadmap towards energy security for Sri Lanka, in the next 20 years. The electricity demand in Sri Lanka is estimated to grow at 4.9% annually for next 20 years, somewhat in line with the GDP growth estimates. However, the LTGEP talks about a significant (55%) share of renewables, majority of the capacity addition will be from Coal and other fossil fuels. There is very limited addition in Solar Power, despite the reduced CAPEX and cost of generation for Solar power. Sri Lanka has a potential to generate 7 GW of Solar power and 4 GW of wind power, catering to 40% & 22% of the total projected power need of 17.6 GW in 2037 \(^ {7}\). There is a need to align stated objectives with execution plans.

**ACKNOWLEDGEMENT**

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[8] https://www.iea.org/countries/sri-lanka

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The effect of using the monoclonal antibodies of the protein ErbB-2 antigen on the lung cancer patients

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Abstract- Cancer is one of the most challenging diseases and up until now. One of the most challenging things about cancer treatment is not the cure itself but the differentiation between the tumor cells and the normal cells. Most of the medical treatments of the cancer today cannot differentiate between the cancer cells and the normal one as well as it damages the hall tissue and it is still considered as a low-effect treatment to be applied in cancer. One of the most popular treatments of this kind is chemotherapy which is known for damaging the hall cells, cancer, and normal ones. Our research is focusing on generating a new therapy that can target the cancer cell itself so it will give us more efficiency ratio to stop cancer and will keep the other cells without any damage. We will use an antibody body for the protein antigen ErbB-2 which is located rabidly in the lung cancer cells’ membrane surface. These antibodies will be produced by the immune system so it will target the tumor cells especially and stop the cell growth and damage it in some cases.

Index Terms- Lung Cancer, ErbB-2 protein, Antigen, Complete blood count, Tumor marker test.

I. INTRODUCTION

Lung cancer is the leading cancer killer of both men and women. It also has one of the lowest five-year survival rates of all cancer types. Lung cancer causes the most cancer deaths worldwide, accounting for 2.1 million new cases and 1.8 million deaths annually. More than half of people with lung cancer die within one year of being diagnosed. In 1987, it surpassed breast cancer to become the leading cause of cancer deaths in women. There will be more than 234,000 new cases of lung cancer in 2018. These new cases accounted for more than 13 percent of all cancer diagnoses. Over the last 10 years, the number of deaths due to lung cancer has decreased about 28 percent among men, but only increased about 3 percent among women. According to these reasons, we can conclude that the lung cancer has non-efficient treatment. The problem of the cancer in general not only the lung cancer is in its therapy methods. Cancer has no effective therapy method or drug up till now. The most popular therapy method today for cancer is the chemotherapy. Chemotherapy is a drug treatment that uses powerful chemicals to kill fast-growing cells in your body. Chemotherapy is most often used to treat cancer, since cancer cells grow and multiply much more quickly than most cells in the body. There are many differ drugs of chemotherapy for the different kinds of cancer. Chemotherapy drugs can be used alone or in combination to treat a wide variety of cancers. In addition to that chemotherapy is an ineffective way to treat many types of cancer, chemotherapy treatment also carries a risk of many dangerous side effects. Chemotherapy side effects damage the body tissues as well as it can develop to organ failures in many cases. Chemotherapy cannot differentiate between the normal cells and the tumor cells; it damages all the cells. Damaging of the normal cells cause most of these massive side effects. Cancer treatment is a very serious problem that researchers try to solve. Most of the researches today focus on finding out new therapies methods which can differentiate between the cancer cells and the tumor cells as a way of making the side effects becomes treatable. Cancer is the uncontrolled growth of abnormal cells anywhere in a body. These abnormal cells are termed cancer cells, malignant cells, or tumor cells. These cells can infiltrate normal body tissues. The mutation of the DNA which happens in genes during the division of the cell leads the cell to make uncontrolled division. The immune system responses to the cancer cell and damage it but only in the earlier phases. The immune response process consists of some action that the immune system takes to stop the tumor cells from growing. At first, Antigens is released from the tumor cells. The dendritic cells present the antigens which are released from the tumor cells to the T cells. After this, T cells are primed activated then, they traffic to tumor cells. After these actions, The T cells infiltrate into tumor to recognize and bind with the tumor cells. At the end after the B cells binds with the antigens, the antibodies of every specific antigen are created, and these antibodies binds with the tumor cells surface’s antigens to kill the tumor cell. Cancer immunoediting process is envisaged to consist of three phases: elimination, equilibrium, and escape. In the Elimination phase, tumor cells are successfully recognized and eliminated by the immune system, thus returning the tissues to their normal state of function. Tumor cells that elude the immunosurveillance phase will progress to the immune editing phase, called the equilibrium phase of advanced oncogenesis, where tumor expansion and metastasis are minimal (tumor dormancy) and usually occur without symptoms.

II. STUDY DESIGN

Our study design is randomized control trial (RCT). RCT is a scientific medical experiment that aims to reduce certain sources of bias when testing the effectiveness of our therapy; this is accomplished by randomly allocating subjects to the two groups.
of our experiment, treating them differently, and then comparing them with respect to a measured response.

III. SAMPLE SIZE AND SELECTION OF SAMPLE

10 mice:
- Females.
- An albino laboratory mouse - BALB/c.
- In the middle age (10 month).
- Diagnosed with the lung cancer in the late phase (tumor represent 60% of tissues).

IV. DATA COLLECTION AND STUDY TOOL

Monoclonal antibodies for Ebrb-2 antigen production Mono' means 'one' and 'clone' means 'identical copy'. Monoclonal antibodies are identical copies of one type of antibody. Antibodies are proteins produced by a type of white blood called lymphocytes. Pathogens have proteins on their surface called antigens. When a pathogen infects the body, the lymphocytes recognize these antigens as foreign and attack them by producing antibodies.

Antibodies bind to specific antigens on pathogens. This means that only one type of antibody will bind to a matching antigen. Scientists discovered that we could make antibodies to bind to antigens on other substances, and not just those on pathogens. Once bound, the antigens - and the substances they are found on - are merged tightly together. This makes them easier to identify and deal with.

Formation of monoclonal antibodies:
1. The antigen is extracted from the cancer cells tumor by Elisa.
2. The Ebrb-2 antigen is injected into a mouse.
3. The mouse naturally produces lymphocytes, which produce antibodies specific to the antigen.
4. Spleen cells which produce the lymphocytes are removed during a small operation.
5. The spleen cells are fused with human cancerous white blood cells called myeloma cells to form hybridoma cells which divide indefinitely.
6. These hybridoma cells divide and produce millions of monoclonal antibodies specific to the original antigen.

Monoclonal Antibody Production

Observational:
The other common side effects for the therapy is observed during time of the experiment after applying the antibodies therapy compared with the other sample which has no therapy applied on:
- Weight loss.
- Lungs failure.

Experimental:
Our experiment extends for one month that all the next procedures is made:
- Complete blood count (CBC). This common blood test measures the amount of various types of blood cells in a sample of your blood. Blood cancers may be detected using this test if too many or too few of a type of blood cell or abnormal cells are found. A bone marrow biopsy may help confirm a diagnosis of a blood cancer.
- Blood protein testing. A test (electrophoresis) to examine various proteins in your blood can aid in detecting certain abnormal immune system proteins (immunoglobulins) that are sometimes elevated in people with multiple myeloma. Other tests, such as a bone marrow biopsy, are used to confirm a suspected diagnosis.
- Tumor marker tests. Tumor markers are chemicals made by tumor cells that can be detected in your blood.
- But tumor markers are also produced by some normal cells in your body, and levels may be significantly elevated in noncancerous conditions. This limits the potential for tumor marker tests to help in diagnosing cancer. Only in extremely rare circumstances would such
a test be considered enough to make a firm diagnosis of cancer.

- The best way to use tumor markers in diagnosing cancer hasn’t been determined. And the use of some tumor marker tests is controversial.
- Examples of tumor markers include prostate-specific antigen (PSA) for prostate cancer, cancer antigen 125 (CA 125) for ovarian cancer, calcitonin for medullary thyroid cancer, alpha-fetoprotein (AFP) for liver cancer and human chorionic gonadotropin (HCG) for germ cell tumors, such as testicular cancer and ovarian cancer.
- Circulating tumor cell tests. Recently developed blood tests are being used to detect cells that have broken away from an original cancer site and are floating in the bloodstream. One circulating tumor cell test has been approved by the Food and Drug Administration to monitor people with breast, colorectal or prostate cancer. This test isn’t commonly used in a clinical setting.
- Test results must be interpreted carefully because several factors can influence test outcomes, such as variations in the body or even the food.

VI. DATA ANALYSIS PLAN AND DATA PRESENTATION

Data is analyzed by Microsoft adobe excel through T-test measuring the difference between results of PCR and antibodies at a level of significance (0.05).

VII. TIMELINE

<table>
<thead>
<tr>
<th>TIMELINE</th>
<th>DAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC test</td>
<td>20 = &gt; 120</td>
</tr>
<tr>
<td>Blood protein testing</td>
<td>First 30 days &amp; last 30 days</td>
</tr>
<tr>
<td>Monoclonal antibodies production</td>
<td>20</td>
</tr>
<tr>
<td>Tumor marker tests</td>
<td>90 = &gt; 120</td>
</tr>
<tr>
<td>Circulating tumor cell test</td>
<td>70</td>
</tr>
<tr>
<td>Monoclonal antibodies injection</td>
<td>At 20</td>
</tr>
<tr>
<td>Evaluation tumor</td>
<td>30</td>
</tr>
<tr>
<td>Analysis</td>
<td>1-2 (through two days)</td>
</tr>
<tr>
<td>Total time</td>
<td>120 days</td>
</tr>
</tbody>
</table>

ACKNOWLEDGMENTS

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Steam Generator for External Resistances

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Abstract - This document presents the design and construction of an water tube type steam generator, which will be used for drying the production process of a paste for children's soaps and for people with dry skin, this project is carried out within the facilities of the Technological University of Tlaxcala, in the Industrial Maintenance Engineering career.

This project is based on theoretical foundations related to the mechanical design of the equipment by finite element, with the application of Solidword in simulations to verify the reliability of the tank structure, the assembly study, the analysis of efforts inherent to the process to which it is found. The equipment has been subjected, performing operational tests to locate faults and also correct them to avoid possible accidents and losses in the product to be made.

This work makes an important contribution to the development of research, since there are no methods similar to the one proposed, to the extent that it will allow the drying of the paste for the preparation of said soaps.

Index Terms- steam generation, heat transfer, combustion process, temperature, pressure

I. INTRODUCTION

The chemist Antoine Lavoiser said that matter is neither created nor destroyed, but transformed, and man, in his desire to make better use of the energy that is extracted from nature, to improve and guarantee his quality of life, has originated various ways to do it for a long time, but uses part of the same energy to achieve it, with various devices, systems and/or equipment. [1]

This way of transforming the chemical energy of a fuel into heat energy is carried out in a device called a boiler or steam generator.

Boilers or steam generators are industrial facilities that, by applying the heat of a solid fuel [2], liquid or gaseous, vaporize water for a wide variety of applications, among which are:

- Heating in industrial processes
- The production of electrical energy

The boiler is a closed container that generates water vapor at pressures above atmospheric, absorbing the heat produced by combustion in the home. The temperature of the liquid rises until it reaches vaporization and remains constant while the liquid turns into vapor. Once the boiling temperature is reached, the operating pressure continues the supply of heat and vaporization begins without temperature variation. As long as there is liquid to evaporate, the mixture of steam and liquid is called wet steam, if the heat supplied is such that the temperature of the steam is the vaporization temperature, it is called dry saturated steam. The heat supplied to carry out this transformation is known as the heat of vaporization. [3]

The steam generator is made of a stainless steel tubular with a height of 50cm, a diameter of 33cm, an electrical resistance for heating it, as well as a layer of fiberglass for protection, a sheet cap, this has temperature and pressure gauges.

II. STEAM GENERATOR

Since ancient times the role of the engineer has been basically the same, trying to know and interpret the mechanisms of nature in order to modify it at the service of man. To do this, he has used his knowledge, intuition, experience and the natural means that he has available at all times. With the great computing power that one has these days, the engineer has great advantages to be able to carry out his mission and address more ambitious challenges every day in solving new problems, whose political, economic, scientific or
technological aspects can have a greater impact on improving the quality of life of man. [4]

A steam generator is an equipment whose objective is the generation of water vapor, which is produced through the transfer of heat from the combustion process, steam generators are the combination of a boiler and a super heater, being a closed container in which, by means of the heat produced by a combustion process, the liquid water in its interior is transformed into steam at a pressure greater than atmospheric. [5]

II. HEAT TRANSFER

Heat transfer is the process by which energy is exchanged in the form of heat between different bodies or between different parts of the same body that are at different temperatures, the transfer of heat occurs from a warmer body to a colder one until the bodies and their environment reach thermal equilibrium. [6]

Heat is transferred by convection, radiation or conduction, when there is a temperature difference between two objects in proximity to each other, the heat transfer cannot be stopped; it can only be slowed down.

Steam generators are used for industrial processes such as generating hot water, bringing liquids to their boiling point, evaporating products or drying systems, according to their principle of operation and construction they are classified between. [7]

Firetube
They are those in which the water circulates inside the tubes and the combustion fumes outside them.

Water tube
They are those in which the water circulates inside the tubes and the combustion fumes outside the tubes.

II. COMBUSTION PROCESS

The combustion process, which takes place in the burner of the steam generator, which transforms the chemical energy of the fuel into thermal energy through activation energy.
III. GENERALITIES

The steam generator is an equipment that consists of different elements for the production of water vapor and this prototype consists of a tubular made of stainless steel tube, and a stainless steel plate with four holes that have the function of the steam outlet, and inputs from temperature and pressure gauges.

Among the current aids for the practice of Engineering is Finite Element Analysis (FEA, for its acronym in English) implemented in various software such as ANSYS, COMSOL and SolidWorks (CosmoWorks).

III. SCHEDULE OF ACTIVITIES

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>SCHEDULED EXECUTION DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>System design and finite element modeling</td>
<td>March, April, May, June, July, August</td>
</tr>
<tr>
<td>Purchase of materials</td>
<td></td>
</tr>
<tr>
<td>Building</td>
<td></td>
</tr>
<tr>
<td>Tests</td>
<td></td>
</tr>
</tbody>
</table>

III. DESIGN AND MODELING.

For heat transfer, the FEA was used, which facilitates the calculation of temperature distributions and air movement by natural convection. Figure 6 shows respectively the temperature and heat flow contour in a steady state configuration, showing the deformations when there is vapor pressure.

Figure 7 shows the stress concentration at a point, which allows us to observe the critical point, where the maximum steam pressure accumulates, showing that the critical point is the upper part of the steam generator.

Figure 8 shows the prediction of the life of the proposed component under critical conditions, determining the critical loads that it must withstand, useful for determining direct calculations of structural strengths at the different pressure concentration points.

III. MATERIAL'S LIST

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>DESCRIPTION</th>
<th>IMAGE</th>
<th>TOTAL COST $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiberglass</td>
<td>1m² fiberglass shee</td>
<td><img src="image.png" alt="Image" /></td>
<td>100</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Quantity</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>----------</td>
<td></td>
</tr>
<tr>
<td>Cable</td>
<td>3m 12 AWG pot conductor</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>Single phase plug</td>
<td>Round plug with three terminals</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Iron laminate</td>
<td>1m² Iron laminate</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Screws</td>
<td>3 Hex head screw 1/4X1 1/2&quot;</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Welding</td>
<td>4 welding electrodes 308</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Resistance</td>
<td>Electric resistance 800 watts</td>
<td>330</td>
<td></td>
</tr>
<tr>
<td>Galvanized nipples, plugs and reduction bush</td>
<td>Elements for vapor pressure test</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>780</strong></td>
<td></td>
</tr>
</tbody>
</table>

### III. CONSTRUCTION PROCEDURE

The water tube tank was built with 10 gauge stainless steel sheet (0.135in or 3.429mm thickness), with hemispherical caps and welded with a 308 coated electrode. The electrical resistance installation is located around the tubular located in the lower part as shown in figure 9. Therefore, Newton's law of cooling or Newtonian cooling establishes that the rate of heat loss from a body is proportional to the difference in temperature between the body and its surroundings. It was determined experimentally by Isaac Newton analyzing the cooling process and for him the cooling rate of a warm body in a colder environment \( T_m \), whose temperature is \( T \), is proportional to the difference between the instantaneous temperature of the body and that of the environment. When the temperature difference between a body and its environment is not too great, the heat transferred in the unit of time to the body or from the body by conduction, convection and radiation is approximately proportional to the difference in temperature between the body and the external environment. [6]

\[
\begin{align*}
\frac{dQ}{dt} &= \alpha A (T - T_a) \\
\frac{dQ}{dt} &= -mc \frac{dT}{dt} \\
\frac{-mc \frac{dT}{dt}}{dt} &= \alpha A (T - T_a) \\
\frac{dT}{dt} &= -k(T - T_a) \\
\int_{T_0}^{T} \frac{dT}{T - T_a} &= -k \int_{0}^{t} dt \\
\ln(T - T_a) &= -kt + \ln(T_0 - T_a) \\
T &= T_0 + (T_n - T_0) e^{-kt}
\end{align*}
\]

Where:
- \( A \) = Body area
- \( \alpha \) = Coefficient of heat exchange, it depends on the geometric shape of the body.
- \( T \) = Body temperature at time \( t \)
- \( T_a \) = ambient temperature
- \( Q \) = Heat transferred
- \( m \) = Mass
- \( C_e \) = Specific heat
- \( t \) = Time
- \( T_0 \) = Initial body temperature

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Once the resistance was installed, the fiberglass was placed, which will allow to maintain the heat generated by the resistance and avoid heat losses, as shown in figure 10. Afterwards, the cap made with stainless steel sheet was placed, in the upper outlet of the tubular was placed the analog pressure gauge, in the first lower outlet a galvanized male plug was installed connected with a terminal nipple to seal and prevent water or steam leaks, during the hermeticity and steam obtaining tests, A temperature thermometer was placed in the second lower outlet of the tubular, assembling the connection with a galvanized bush type reduction, a bell nipple with a gasket, a coupling and a brass bell nipple.

![Figure 9 Electrical resistance installation](image)

### IV. RESULTS

Once the construction of the generator was completed, the pertinent tests were carried out to detect and thus be able to correct water or steam leaks, see figure 11, thanks to the measurement equipment that was adapted to obtain the temperature reading, the following data were collected (Table 1, graph 1) where the relationship between the time it takes for the water to reach its maximum temperature of 100 °C is shown, it is observed that during the first 20 minutes the water remains at room temperature, but that from minute 25 the temperature begins to rise rapidly (graph1) and that from minute 45 the water reaches its maximum temperature starting with the boiling point.

### Table 1 Heating

<table>
<thead>
<tr>
<th>Minutes</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>26.8</td>
</tr>
<tr>
<td>15</td>
<td>28</td>
</tr>
<tr>
<td>20</td>
<td>31.9</td>
</tr>
<tr>
<td>25</td>
<td>49.2</td>
</tr>
<tr>
<td>30</td>
<td>68.5</td>
</tr>
<tr>
<td>35</td>
<td>86</td>
</tr>
<tr>
<td>45</td>
<td>100</td>
</tr>
</tbody>
</table>

![Graph 1 Heating](image)

For the soap paste drying process, it is important to take into account the cooling time, therefore the data was collected (table 2, graph 2) where we observe that the time it takes for the water to return to room temperature is longer. In the first 30 minutes we can still have the temperature required for the process.

### Table 2 Cooling

<table>
<thead>
<tr>
<th>Minutes</th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td>19</td>
<td>89.8</td>
</tr>
<tr>
<td>25</td>
<td>78.5</td>
</tr>
<tr>
<td>29</td>
<td>70.2</td>
</tr>
<tr>
<td>32</td>
<td>66</td>
</tr>
<tr>
<td>37</td>
<td>60.9</td>
</tr>
<tr>
<td>43</td>
<td>55</td>
</tr>
<tr>
<td>45</td>
<td>48.4</td>
</tr>
<tr>
<td>49</td>
<td>37.1</td>
</tr>
<tr>
<td>55</td>
<td>25</td>
</tr>
</tbody>
</table>
The temperature and the amount of steam that this prototype generates is adequate and necessary to carry out the drying process of soap paste, fulfilling the main objective. The results obtained were satisfactory for this steam generator prototype that achieves a temperature of 100 °C, a pressure of 0.7 bar, 12.5 psi. and a current consumption of 7 Amp. At 127 volts, see figure 11.

V. CONCLUSION

The project requires a constant steam pressure for a good soap drying process, it is necessary to have a certain temperature, if the temperature exceeds the limit required for the paste generation process, it can cause poor drying for the soaps, It can evaporate very quickly the water inside the container causing it to burn and in some cases cause accidents, in addition, a high temperature can generate excess steam and if we do not have a relief valve this can cause the container to explode causing accidents to people or the installations.

To avoid this, an electronic control will be designed in a second stage based on a temperature sensor programmed in Labview, this will allow us to control and monitor the temperature of the resistances so that when it exceeds the limit, the resistances turn off, and when lower the temperature, the resistance turns on again and continue with the process.

For the moment, in this first stage, with the results obtained in this prototype, it is possible to meet the objective of generating the steam that is needed for a pilot soap production plant, in the part of the drying of pasta, so this stage remains concluded and will continue with the other components that make up the production system.

This proposed system is a new model.

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Efficient lamp design for office or personal cubicles.

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Abstract- This document presents the study that was conducted on two electric lamps, one square lamp of 25w at 120 volts and the other, a ring light at 14w at 5 volts. It was documented and demonstrated by analyzing two variables, one concerning the electric consumption with an electric current analysis circuit during the operation period, comparing the power output of both lamps and the second regarding the analysis of light intensity (lumens) with an electric circuit including a LDR photoresistor, to value which lamp delivers more light intensity.

Once data on both issues of electricity consumption and lighting were obtained, the studies were contrasted graphically, comparing which lamp delivers more lumens with less current as well as verifying which is the most efficient.

Index Terms- Illumination, Luxes, Saving, Stream

I. Introduction

The purpose of this study is to evaluate the consumption of lighting and current to make the lighting system as efficient as possible, having a projection to the environment, showing the importance and use of renewable energy by using photovoltaic panels or in the subsequent case, make a change of lamps to minimize power consumption and increase the lighting.

The advantages of having electrical energy in the form of alternating current are diverse:

- The profit and benefits are focused on the non consumption of commercial energy.
- The use of renewable energy that, in this case, is produced by solar panels, taking into account that there is an improvement benefit for the environment.
- Economic care (less money consumption).

With the previous project investigations that were carried out, the value of both consumptions of energy was known. It’s more efficient to have a system of energy that limits the commercial consumption, but the quality of the illumination will be maintained and the lamps used are led lamps, having a better efficiency according to the quality of energy. We will stop using this commercial consumption thanks to the research. With this project, we hope that in the future the implementation of this kind of lamps will be achieved.

Theoretical framework

The history of energy begins since the remote times where mankind started to rub stones together to obtain fire, improve their livelihood, as well as to survive. It is here where the man realizes that energy arises, noticing that through time, it has been a great benefit for the society, such as the electrical energy, energy applied to industrial processes, energy used in means of transport, among others. Energy also occupies a very important role in the scientific and technological advances that benefit humanity. [1]

The oil crisis began in October 16th, 1973, which, given the increase in price coupled with the world's dependence on oil, caused an inflationary effect and a reduction in economic activity, having the use of energy as subsequent demand. [2]
According to the research carried out, lamps have a contribution against climate change. In Mexico, about a fifth of the energy produced is destined to domestic lighting by means of incandescent electric bulbs. These lamps are an excellent technology for saving energy compared to incandescent bulbs (they can consume up to 75% less energy) and have a longer useful life.

In this type of areas with an illumination of 400 to 550 lumens is more than enough, it could be observed that a great change in energy consumption and efficiency levels would be much better. Evaluating the correct lighting levels in order to establish optimal requirements in each and every one of the areas in work centers is an obligation of the companies, or employers, and it’s included in the current regulation NOM 025-STPS-2008 of the Labor Secretary. This regulation seeks to control the right lighting in work centers for a correct performance of the functions of each worker, in a safe and healthy environment. The regulation contemplates the obligations that the company or the employer has regarding the lighting conditions of work centers. Some of them are:

- Control the optimal lighting levels in work areas, according to the stipulations of the regulations depending on the place where the tasks are performed, the lighting can range from 20 lx, such as in outdoor areas (patios or parking lots) to 2,000 lx in activities that require a high degree of specialization in distinguishing details (within workshops where small parts are worked on for very long periods).

- Practice annual exams of visual acuity, campimetry and color perception to the workers that develop their activities in areas of the work center that have special illumination. [3]

<table>
<thead>
<tr>
<th>Visual Task of the Job</th>
<th>Work Area</th>
<th>Minimum Lighting Levels (lx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdoors: distinguish the transit area, walking, surveillance, vehicle movement.</td>
<td>General exteriors: patios and parking lots</td>
<td>20</td>
</tr>
<tr>
<td>Indoors: distinguish the transit area, walking, surveillance, vehicle movement.</td>
<td>General interiors: low-movement warehouses, corridors, staircases, covered parking lots, subway mine works, emergency lighting.</td>
<td>50</td>
</tr>
<tr>
<td>Indoors.</td>
<td>Circulation areas and corridors; waiting rooms; restrooms; storage rooms; platforms; boiler rooms</td>
<td>100</td>
</tr>
<tr>
<td>Personnel Services: rough storage, reception and dispatch, surveillance booths, compressor rooms and coppersmith.</td>
<td>Personnel Services: rough storage, reception and dispatch, surveillance booths, compressor rooms and coppersmith.</td>
<td>200</td>
</tr>
<tr>
<td>Moderate distinction of details: simple assembly, medium bench and machine work, simple inspection, packaging and office work.</td>
<td>Workshops: packaging and assembly areas, classrooms and offices</td>
<td>300</td>
</tr>
<tr>
<td>Clear distinction of details: delicate machining and finishing, moderately difficult inspection assembly, information capture and processing, handling of instruments and laboratory equipment.</td>
<td>Precision workshops: computer rooms, drawing areas, laboratories.</td>
<td>500</td>
</tr>
</tbody>
</table>
Commercialement, we have a great variety of lamps in different powers (Illustration 1). In the investigation carried out by our work team, the existence of polluting harmonics in the electrical power network with this type of equipment is shown, which confirms the investigation previously carried out. [4]. [1].

![Equivalence table image]

Table 2 Equivalence table / lacasadellalampara

According to a study briefly carried out by us, it was confirmed that in our institution we are consuming a lot of energy unnecessarily, because according to the NOM 025-STPS-2008 standard, we are consuming more energy than necessary for a study area or a small area (2 * 3 m²), since we have high-power lamps and they are delivering more lumens than necessary, we looked for the best lamps and types of light bulbs for our home, in addition to helping us reduce consumption of energy, have less harmonics and better or equal lighting. The survey was conducted with 117 people to determine the use of energy-saving lamps in their homes, of which 91% of them use energy-saving lamps of 25-35 W at home, the equivalent of 45% of the respondents said that they used them to illuminate small areas with measurements of 3x2 square meters, based on the data obtained and the analysis systems studies carried out on the consumption and the intensity of light (lumens).

We can define electrical disturbances as perturbations that occur in any electrical system, which not necessarily reflect the absence of voltage, but rather manifest as variations in the voltage waveform and affect the operation of various types of equipment connected to the system, or, in other words, any disturbance in electrical power systems that manifests itself in deviations from the proper voltage, current or frequency conditions, which can result in equipment malfunction or misoperation.

**Power Quality**
It refers to the supply of energy to elements, equipment and electrical or electronic devices, with the appropriate characteristics and conditions, allowing them to maintain their continuity without affecting their performance or causing a component failure. Electrical energy is considered a necessary element in daily life; therefore, it is essential to have an uninterrupted quality supply, without generating contamination in electrical energy.

The schedule change implemented in 1996, largely allows the reduction of electricity consumption during the months of April to October, as shown in table 4.

We propose a design that is functional and meets many of the lighting requirements requested by society. A survey was conducted on 117 people, of whom, about 91% use energy-saving light bulbs, and 45% of these want to illuminate a small indoor area.

**Methodology:**

Our 12-led lamp design with power switching allows for a wide range of lighting with the same amount of lumens and lower power consumption.

Comparative charts according to the current regulations NOM 025-STPS-2008

The first graph shows the illumination capacity of 6 LEDs and / or energy consumption to verify which goes according to our needs.

The following graph shows the amount of Watts consumed by a 6 LED lamp, taking into account that the oscillation has a very marked variation.
The next graph aims to show the amount of luxes consumed by the lamps having a variation of 6 leds, obtaining graphic data that the 12 led lamp has a continuous consumption.

Comparison of the current in both lamps obtained through a circuit with which we can graph the power of the lamp and make a decisive study to make the appropriate changes to obtain real values by which we can graph and act to make comparisons and determinant changes. The oscillation that exists in the current of 12 LEDs of the lamp having more consumption is shown here.
Comparison of luxes of all the tests made in all the powers of our lamp, our conventional lamp when being connected, and our current lamp with led light.

They were obtained through our experiments for the measurement of lux and current.

- If we are working with the SCT-013-030 sensor, it means that the output is in a +/-1V range, then the circuit that we will use is this:
Audio datasheet connector: We used it as a standard connector since it’s easier to obtain analog data in an exact way; it helped to obtain values received from the current of both lamps to make the comparisons needed to finish the study.

**Electric Scheme**

In an electrical diagram, the correct way to connect the circuit for measurement would be as follows (Illustration 7):

![Electric Diagram](image-url)
The electrical assembly on a protoboard would look like this:

References


[2] [Online].


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Performance of Ultra Low Sulphur Diesel Fuel Additives and its Side Effects

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Abstract- Demand of ultra low Sulphur diesel fuel and cost of additives have created interest in fuel additives. Cetane improver (CI) and lubricity additive (LA) are being regularly added in the ultra low Sulphur diesel (ULSD) fuel to meet the requirements of the specification. The additives are always costlier than diesel fuel and the price depends on the performance of additives. Sometimes, additives may have side effects on other properties of fuel. Hence additive’s performance as well as its adverse effect on other properties of fuel are paramount while using additives.

Nayara Energy Research and Development team has conducted laboratory scale experimental study to evaluate performance and side effects of different additives used for ULSD fuel viz. cetane improvers and acid & ester based lubricity additives. Following are the aspects studied using ULSD fuel:

1) Alternate cetane improvers.  
2) Performance of cetane improvers.  
3) Effect of cetane improver on lubricity of ULSD fuel.  
4) Performance of lubricity additives in presence of cetane improvers.  
5) Effect of cetane improver on twenty other Diesel fuel properties.  
6) Two months stability study for key Diesel fuel properties.

The observations derived from experimental study are quite interesting and valuable. The study results clearly indicate that, cetane improver can deteriorate the lubricity of fuel and also affect the performance of lubricity additives. 2EHN is increasing total nitrogen content of the fuel which will produce more NOx while combustion. Ester based lubricity additives perform well as compared to acid based lubricity additives. Hence globally, the study work will be highly useful for petroleum refineries to select the best additives and combination of additives to produce ULSD fuel. It will be equally important for additive manufacturers to develop and produce best additives for ULSD fuel. This experimental study work will also be helpful to research and analytical scientists for evaluation of additives performance and its side effects. It will provide information of alternate additives / improvers to various users.

Study report includes the observations and test results of various laboratory experiments, the performance evaluation data of cetane improvers, the side effect of cetane improvers, the performance of lubricity additives (acid based and ester based) in presence of cetane improvers. Study report also includes two months stability study results and literature study information.

Index Terms—Cetane Improver, Diesel, Di-Tertiary Butyl Peroxide (DTBP), 2-ethylhexyl nitrate (2-EHN), Lubricity Additive, Ultra Low Sulphur Diesel (ULSD)

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Performance of Ultra Low Sulphur Diesel Fuel Additives and its Side Effects

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Introduction

Diesel fuel is being used globally for many applications mainly for transportation, farm & construction equipment, heating etc. Diesel fuel used for automobile engine is having stringent specifications to provide better performance of engine as well as to control exhaust emission level. Looking to the ULSD fuel demand and economics of refinery product margin, most of the refineries target to upgrade maximum diesel components into diesel product. Additives are being used to produce diesel fuel meeting the specification requirements. The cetane number and lubricity of diesel fuel are key properties which can be controlled by addition of improvers / additives.

Cetane Number is a performance parameter of diesel fuel and it is measured by using standard engine method ASTM D 613. The cetane number depends on chemical composition of fuel, which are either from crude oil or generated through refinery processes. Diesel blending components produced from refinery have cetene number in the range of 25 to 70 and required specification is mostly 51 minimum. There are two primary ways to improve cetane number of diesel fuel (a) refinery processes viz hydro treating and hydro cracking and (b) addition of cetane improver (CI). Most of refineries use hydro treating / hydro cracking technique to reduce sulphur level as well as to improve cetane number. These technique can enhance cetane number up to certain level and after that, if required, refineries use cetane improver to meet the required specification.

Lubricity of ULSD fuel is primarily required to minimize wear & tear of engine components and it is measured by using standard method ISO 12156 (Lubricity by High Frequency Reciprocating Rig). As per BIS IS-1460 Diesel fuel standard, the specification is 460 microns max, while as per IQCM (Industrial Quality Control Manual of India) requirement is 420 microns max for coastal transfer, hence refineries needs to produce fuel meeting the above requirements. Lubricity of fuel is also depends on chemical composition and treatment employed during production of fuel. Since ULSD fuel specification demands for lower total Sulphur (10 ppm Max) to reduce environmental impact, the fuel has to pass through severe hydro treatments. The hydro treatment also decompose chemical molecules which are having natural lubricity behaviour. The straight run diesel is having lubricity approx. 500 micron and it became 600+ after hydro treatment, which can be then corrected by addition of lubricity additives (LA).

The additives are always costlier than fuel and the consumption of additives are increased drastically after implementation of ULSD fuel specification. The price of additives are mostly controlled by the performance data of additives for specific application, considering there is no harm on other properties of fuel, but literature / study data is not available for the same in public domain. Currently, only 2EHN is being used as cetane improver and alternate cetane improvers are not well known. For lubricity improvers, acid based and ester based are being widely used.

Hence, the need arises to identify alternate cetane improvers as well as conduct comprehensive study on performance of ULSD fuel additives and its side effects to effectively manage and optimize the fuel additives.

Nayara Energy Research and Development team has conducted literature study as well as laboratory experiments to conclude comprehensive study for ULSD fuel additives.
Following aspects are studied,

1) Alternate cetane improvers
2) Performance of cetane improvers.
3) Effect of cetane improvers on lubricity of ULSD fuel.
4) Performance of lubricity additives in presence of cetane improver.
5) Effect of cetane improver on twenty other diesel properties.
6) Two months stability study for key diesel properties.

Laboratory Experiments and Test Results

Stepwise experimental study has been conducted and all the tests are performed in NABL accredited laboratory using standard test methods mentioned in the diesel fuel specification.

1) Alternate Cetane Improvers:

Since a long period of time, 2-EHN is being used as cetane improver globally because of its cost effectiveness and dosage level in the range of up to 5000 wt. ppm. Through literature study, we come to know, that some of alkyl nitrates, peroxides components are having capability to improve cetane number of Diesel fuels. As per California diesel regulation (CARB) 13 CCR 2293, di-tertiary butyl peroxide (DTBP) chemical is permitted as cetane improver up to 10000 wt. ppm. Hence DTBP chemical is considered as alternate cetane improver for laboratory scale experimental work.

2) Performance of Cetane Improver (CI):

Generally, cetane improver performance is defined by increase of the cetane number of the diesel fuel against the added concentration of cetane improver and it is a key factor for commercial acceptance.

ULSD fuel having 43.2 cetane number was used for the study of cetane number response of 2-EHN and DTBP at various concentration in the range of 0 to 4000 wt. ppm. Tests are performed as per ASTM D 613 test method and test results are tabulated in table-1/Fig-1.

**Table 1**

<table>
<thead>
<tr>
<th>Sample Details</th>
<th>2-EHN</th>
<th>DTBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSD + Zero CI</td>
<td>43.2</td>
<td>43.2</td>
</tr>
<tr>
<td>ULSD + 1000 ppm CI</td>
<td>46.4</td>
<td>45.8</td>
</tr>
<tr>
<td>ULSD + 2000 ppm CI</td>
<td>48.7</td>
<td>47.6</td>
</tr>
<tr>
<td>ULSD + 3000 ppm CI</td>
<td>50.6</td>
<td>49.5</td>
</tr>
<tr>
<td>ULSD + 4000 ppm CI</td>
<td>52.4</td>
<td>51.0</td>
</tr>
</tbody>
</table>

**Observations**: Experimental study data indicate that, both, 2-EHN and DTBP are increasing cetane number of ULSD fuel and response delta found to be lower at higher dosage level. The relative performance of DTBP as cetane improver is found lower than 2EHN.
3) **Effect of Cetane Improvers on Lubricity of Diesel Fuel.**

Study has been conducted to identify the effect of cetane improvers (2EHN and DTBP) at various concentration on lubricity of ULSD fuel, which is having lubricity of 600 microns. Tests are performed as per standard test method ISO 12156 (Lubricity by High Frequency Reciprocating Rig). All the test results of lubricity are in microns WSD and tabulated in table-2 / Fig-2.

**Observations:**

Table-2 test results indicates that, there is no adverse effect of DTBP on ULSD fuel even at higher concentration. 2-EHN has increased wear scar diameter (indication of lubricity deterioration) of fuel from 600 to 830 microns and it is proportional to the dosage. Hence, more quantity of lubricity additives will be required to correct the same.

4) **Performance of Lubricity Additives in Presence of Cetane Improver**

As per BIS IS-1460 Diesel fuel standard, specification is 460 microns max, while as per IQCM (Industrial Quality Control Manual of India) requirement is 420 microns max for coastal transfer, hence refinery needs to produce fuel meeting the above requirements.

A) **Performance of Acid Based Lubricity Additive**

In this experiment, ULSD sample is collected, which does not have any additives and three sets of samples were prepared as mentioned below to see the performance of acid based lubricity additive with and without cetane improvers.

Set-1, ULSD fuel with acid based lubricity additive at different concentration

Set-2, ULSD fuel + 1900 ppm 2EHN + acid based lubricity additive at different concentration

Set-3 ULSD fuel + 1900 ppm DTBP + acid based lubricity additive at different concentration

All three sets of sample were tested for lubricity test and are presented in tabular and graphically form below.
Table 3

<table>
<thead>
<tr>
<th>Acid Based LA</th>
<th>ULSD + LA</th>
<th>ULSD + 1900 ppm 2EHN + LA</th>
<th>ULSD + 1900 ppm DTBP + LA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 wt. ppm</td>
<td>600</td>
<td>780</td>
<td>593</td>
</tr>
<tr>
<td>180</td>
<td>440</td>
<td>500</td>
<td>420</td>
</tr>
<tr>
<td>230</td>
<td>405</td>
<td>460</td>
<td>380</td>
</tr>
<tr>
<td>280</td>
<td>387</td>
<td>430</td>
<td>399</td>
</tr>
<tr>
<td>330</td>
<td>370</td>
<td>480</td>
<td>401</td>
</tr>
</tbody>
</table>

Observations:

a) ULSD + LA: Lubricity WSD reduced linearly when diesel is not having any cetane improver.

b) ULSD + LA + DTBP: Lubricity WSD reduced linearly up to 380 microns and after that there is no effect of additive.

c) ULSD + LA + 2-EHN: 1) Initial lubricity of fuel found increased from 600 to 780 microns  2) Lubricity is reduced only up to 430 microns  3) After 325 ppm LA dosage, lubricity is further increasing, it indicates that 2EHN has adverse effect on performance of acid based LA. 4) This problem can be further worsen when 2-EHN dosing will be at higher level.

d) Study was conducted using different acid based lubricity additives, but found same behavior.

B) Performance of Ester Based Lubricity Additive

In this experiment, ULSD fuel sample having 630 microns lubricity was selected for the study and then high concentration of cetane improver (3000 wt ppm 2EHN or DTBP) was added. Further ester based lubricity additives dosage at 150 & 200 ppm into it and then tested for lubricity. The observed test results are tabulated in table-4 below.
**Table 4**

<table>
<thead>
<tr>
<th>Lubricity Additive Details</th>
<th>Ester Based LA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubricity of ULSD (Without CI &amp; LA) microns</td>
<td>630</td>
</tr>
<tr>
<td>Dosage of Cetane Improver, ppm</td>
<td>3000 2EHN</td>
</tr>
<tr>
<td>Dosage of Lubricity Additive, ppm</td>
<td>150</td>
</tr>
<tr>
<td>Lubricity of ULSD in microns</td>
<td>455</td>
</tr>
</tbody>
</table>

**Observations:** Ester based lubricity additives are more effective compared to acid based LA.

### 5 Effect of Cetane Improvers on Diesel Properties

Most of the standard diesel specifications are having 18 to 22 test properties, hence the study was extended for cetane improvers effect on all properties which are mandatory as per product specification. Three samples are prepared viz a) Diesel fuel + LA b) Diesel fuel + LA + 3000 ppm 2EHN and 3) Diesel fuel + LA + 3000 ppm DTBP. All three samples are tested for full specification properties using standard test method and test results are tabulated in separate Annexure-A.

**Observations:** There is no effect on other properties of fuel except 2EHN has increased Nitrogen content of fuel sample.

### 6 Two Months Stability Study for key Diesel Properties

To verify the stability of diesel fuel with additives, two months stability study was conducted. All three Diesel samples were prepared and tested at experiment -5 are retested after two months for key properties.

**Observations:** All key properties of fuel samples are found close to initial test results.

**Conclusions:**

Based on the various test results and observations of above laboratory experiments, it is concluded that,

**Cetane Improvers:**

1) Both cetane improvers (2-EHN and DTBP) found to be capable to increase cetane number of diesel fuel.
2) Both cetane improver’s (2-EHN and DTBP) response delta found to be lower at higher dosage compared to initial.
3) The relative performance of DTBP as cetane improver is found to be lower than 2EHN.
4) DTBP is not having any adverse effect on any diesel properties even at higher dosage.
5) Based on study observations and information available through literature survey (California regulation), DTBP can be used as cetane improver.
6) 2EHN is deteriorating lubricity of diesel fuel and it is proportional to dosage.
7) 2EHN is also has an adverse effect on performance of acid based lubricity additives and becomes worse at higher dosage. It may be impossible to control lubricity at extreme high level of 2-EHN dosing.

**Lubricity Improvers:**
8) Performance of acid based as well as ester based lubricity additive in diesel without cetane improver found normal.
9) Performance of ester based lubricity additives is better than acid based at same dosage level.
10) Performance of ester based lubricity additive found to be normal with both cetane improvers.
11) Performance of acid based lubricity additives found to be normal with DTBP but abnormal in presence of 2EHN cetane improver and becomes worse at higher dosage level, hence may be difficult to achieve target specification.
12) User has to develop proper additives evaluation system for ULSD fuel to manage and optimize additives consumption.

**Effect on other fuel properties and stability:**

13) There is no effect of DTBP on any other properties of Diesel fuel
14) There is no effect of 2EHN on other properties of Diesel fuel except nitrogen content, it is increasing from 13 to 295 ppm.
15) All key properties of Diesel fuel with additives found to be stable up to two months

**Benefits:**
The observations derived from experimental study work are quite interesting and valuable, hence following benefits envisaged,

- The study work will be highly useful globally for petroleum refinery to select the best additives and combination of additives to produce USLD fuel. It will also help to develop evaluation procedure.
- It will be equally important for the additive manufacturer to develop and produce best additives for ULSD fuel.
- It will be helpful to research and analytical scientists for evaluation of additives performance and its side effects.
- It will provide information of alternate additives / improvers to various users.

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**References:**

1) Bureau of Indian Standard, IS 1460, Automotive Diesel Fuel-Specification
2) ISO 12156-1, Assessment of lubricity using the high-frequency reciprocating rig (HFRR) — Part 1: Test method
3) ASTM D 613, Standard Test Method for Cetane Number of Diesel Fuel Oil
4) California’s Diesel Fuel Program, November 29, 2018, Oil & Gas and GHG Mitigation Branch California Air Resources Board (CARB)
Annexure-A

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Test Parameters / Properties</th>
<th>Method</th>
<th>Unit</th>
<th>Limit</th>
<th>Diesel with LA</th>
<th>Diesel + 3000 ppm 2EHN</th>
<th>Diesel + 3000 ppm DTBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Appearance</td>
<td>Visual</td>
<td>---</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td>2</td>
<td>Acidity, Inorganic</td>
<td>ASTM D 974</td>
<td>mg KOH/g</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>3</td>
<td>Acidity, Total</td>
<td>ASTM D 974</td>
<td>mg KOH/g</td>
<td>0.20 Max</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>4</td>
<td>Ash</td>
<td>ASTM D 482</td>
<td>% mass</td>
<td>0.01 Max</td>
<td>0.004</td>
<td>0.005</td>
<td>0.004</td>
</tr>
<tr>
<td>5</td>
<td>Carbon Residue on 10% residue</td>
<td>ASTM D 4530</td>
<td>% mass</td>
<td>0.3 Max</td>
<td>0.10</td>
<td>0.11</td>
<td>0.10</td>
</tr>
<tr>
<td>6</td>
<td>Cetan number</td>
<td>ASTM D 613</td>
<td>---</td>
<td>51 Min</td>
<td>42.7</td>
<td>49.9</td>
<td>48.3</td>
</tr>
<tr>
<td>7</td>
<td>Cetan Index</td>
<td>ASTM D 4737</td>
<td>---</td>
<td>46 Min</td>
<td>46.5</td>
<td>46.3</td>
<td>46.3</td>
</tr>
<tr>
<td>8</td>
<td>Pour point</td>
<td>ASTM D 97</td>
<td>C</td>
<td>Note 2</td>
<td>-6</td>
<td>-6</td>
<td>-6</td>
</tr>
<tr>
<td>9</td>
<td>Copper Strip Corrosion</td>
<td>ASTM D 130</td>
<td>---</td>
<td>1 Max</td>
<td>1b</td>
<td>1b</td>
<td>1b</td>
</tr>
<tr>
<td>10</td>
<td>Flash point, Able</td>
<td>IP 170</td>
<td>C</td>
<td>35 Min</td>
<td>41</td>
<td>41</td>
<td>40.5</td>
</tr>
<tr>
<td>11</td>
<td>KV at 40 C</td>
<td>ASTM D 445</td>
<td>cSt</td>
<td>2.0 to 4.5</td>
<td>1.912</td>
<td>1.915</td>
<td>1.911</td>
</tr>
<tr>
<td>12</td>
<td>Total contamination</td>
<td>EN12662</td>
<td>mg/kg</td>
<td>24 Max</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>Density at 15 C</td>
<td>ASTM D 4052</td>
<td>mg/kg</td>
<td>815-845</td>
<td>829.9</td>
<td>830.4</td>
<td>829.9</td>
</tr>
<tr>
<td>14</td>
<td>Total Sulphur</td>
<td>ASTM D 5453</td>
<td>mg/kg</td>
<td>50 Max</td>
<td>37.0</td>
<td>42.8</td>
<td>37.6</td>
</tr>
<tr>
<td>15</td>
<td>Water content</td>
<td>ISO12937</td>
<td>mg/kg</td>
<td>200 Max</td>
<td>132</td>
<td>138</td>
<td>136</td>
</tr>
<tr>
<td>16</td>
<td>CFPP</td>
<td>ASTM D 6371</td>
<td>C</td>
<td>Note 3</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td>17</td>
<td>Oxidation stability</td>
<td>ASTM D 2274</td>
<td>g/m3</td>
<td>25 Max</td>
<td>2.6</td>
<td>2.3</td>
<td>1.1</td>
</tr>
<tr>
<td>18</td>
<td>PAH</td>
<td>IP 391</td>
<td>% mass</td>
<td>8 Max</td>
<td>3.588</td>
<td>3.364</td>
<td>3.597</td>
</tr>
<tr>
<td>19</td>
<td>Lubricity WSD at 60 C</td>
<td>ISO 12156-1</td>
<td>microns</td>
<td>460 max</td>
<td>400</td>
<td>486</td>
<td>406</td>
</tr>
<tr>
<td>20</td>
<td>Total Nitrogen</td>
<td>ASTM D 4926</td>
<td>ppm</td>
<td>13</td>
<td>295</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>2 EHN Concentration</td>
<td>FTIR</td>
<td>ppm</td>
<td>&lt;100</td>
<td>3366</td>
<td>&lt;100</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Dist. recovery @ 95%</td>
<td>ASTM D 86</td>
<td>C</td>
<td>360 Max</td>
<td>350.0</td>
<td>351.6</td>
<td>350.8</td>
</tr>
<tr>
<td>22a</td>
<td>Dist. Perc. Rec. at 360°C</td>
<td>ASTM D 86</td>
<td>Vol%</td>
<td>90 Min</td>
<td>96.7</td>
<td>96.4</td>
<td>96.6</td>
</tr>
<tr>
<td>22b</td>
<td>Residue</td>
<td>ASTM D 86</td>
<td>Vol%</td>
<td>1.5</td>
<td>0.9</td>
<td>1.3</td>
<td></td>
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</tbody>
</table>
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Prevalence of Helicobacter Pylori Among Clients Attending Private Medical Laboratory Diagnostic Center In Karsh, Abuja, Nigeria


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Abstract- Helicobacter pylori infection is the most common chronic bacterial infection around the world. It is a major aetiologial factor in chronic gastric carcinoma and gastric mucosal associated lymphoid tissue lymphoma. A study on the prevalence of Helicobacter pylori was carried out among 204 clients comprised 118 males and 86 females aged 11-50 years between September, 2019 to march, 2020. Blood samples were collected from clients and analyzed to determine the presence of Helicobacter pylori using Global Device H. pylori Antibody Rapid test cassette. Out of 204 clients screened 120 (58.8%) were positive for Helicobacter pylori. The result shows that males were more infected than females with 64(31.4%) and 56(27.4%) positive cases respectively. The infection varied according to age group where 31-40 years age had the highest infection rate of 80(27.9%), followed by 21-30 years 57(20.1%), 41-50 years 12(5.9%) and age group 11-20 years had the least prevalence 10(4.9%). Distribution according to marital status shows that single had higher prevalence of 77(37.7%) and married had the least 43(21.1%). The distribution according to sources of drinking water shows that sachet water had the highest prevalent 81(38.2%), followed by bore hole 27(14.7%), well 10(4.9%) and pipe-borne water had the least 2(1.0%). Stream/rivers had zero prevalence. There was no statistical significance relationship different between age, sex, marital status and sources of drinking water and prevalence of Helicobacter pylori infection among the clients examined. This study recorded a higher prevalence rate of Helicobacter pylori infection among clients studied strongly suggest public health enlightenment campaign on Helicobacter pylori causes and prevention should be promoted and strengthened. Good personal and environmental hygiene, provision of clean portable drinking water will significantly reduce the burden of the infection. Authors recommend the inclusion of private medical laboratory into government health policies on Helicobacter pylori.

Index Terms- Karshi, Private, Laboratory, Abuja, Medical, Helicobacter, Pylori.

I. INTRODUCTION

Helicobacter pylori (H.pylori) previously named Campylobacter pylori is a spiral, flagellated gram negative, microaerophilic bacterium found in the stomach with a capability for abundant urease production which has been implicated in several upper gastrointestinal diseases that present dyspepsis. It is a major aetiological factor in chronic gastritis, peptic ulcer disease, gastric carcinoma and gastric mucosal associated lymphoid tissue (MALT) lymphoma ([37] [44]).

Helicobacter pylori infection is the most common chronic bacterial infection around the world [23]. It causes frequently reoccurring epigastric pain or discomfort which is believed to originate in the gastric duodenal region. This may be associated with other upper gastrointestinal (GI) symptoms such as nausea, belching, vomiting, post prandial fullness, and early satiety [5]. Burning abdominal pain that extends from the naval to the chest, which ranges from mild to severe. Also, changes in appetite, blood or dark stool, indigestion, weight loss. Chronic dyspeptic symptoms can be continuous, intermittent (episodic) or recurrent ([20] [40]).

It has been shown at 50% of adults in developed countries and 90% of adults in developing countries were positive of serum antibodies against H.pylori [17]. The critical period at which H.pylori is acquired is during childhood, especially in the developing countries and areas of overcrowding and socioeconomic deprivation [30].

Helicobacter pylori is found down the middle the number of inhabitants on the planet. Its prevalence indicates enormous topographical varieties. In different creating nations over 80% of the populace in Helicobacter pylori positive even at a youthful age [39]. The prevalence in industrialized nations by and large stages under 40% and is significantly lower in young sters and teenagers than in grown up. The predominance of H.pylori relates with financial status, specifically in connection to living conditions at young age [25].

H.pylori infection is common worldwide with prevalence rates ranging from 30 to 40% in the united states, 80 to 90% in South Africa and 70 to 90% in Africa. It is more common in developing countries and its prevalence increases with age from 20% among teenagers to 50 to 60% of subjects in the 6th and 7th decades of life [3]. In a hyperdemic area like Nigeria, studies by [7] in Kano reported an H.pylori prevalence of 81%, [28] in Jos, found a prevalence of 87% while [2] reported 73% in Southwest. [22] reported 12.7% in Warri. [1] reported 64% in Ibadan. [21]
reported 54% in Nassarawa State, North Central. [38] reported 89.7% in Delta State South South Nigeria.

Studies from many African Countries reported similar prevalence rates of 91.7% in Egypt [14], 97% in Gambia [41], 75.5% in Morocco [10] and 65.7% in Ethiopia [27].

Similarly, in Asia prevalence rates of 92% have been reported in Bangladesh [4] and 62% prevalence was found in Chinese [42].

The prevalence of H. pylori infection varies between and within Countries in relation to age, race, ethnicity and geographical area of the population [31].

Human is the main reservoir of this infection. Infected mother and older siblings are important factors for H. pylori transmission to children ([11] [17] [24]). The identified factors of increased infection risk including source of drinking water, use of pit latrine and wealth index driving transmission. These factors compiled with re-crudecence or re-infection from multiple sources accounts for the continuous high prevalence of H. pylori infection in Africa [6]. Though the route of transmission of this infection is not well established, possible routes of transmission such as person-person, oral-oral and faecal-oral have been suggested.

The ability of the pathogen to survive for some days in water buttressed the fact of possible water transmission ([12] [13]).

Various diagnostic tests for H. pylori have been developed and they can be broadly classified into invasive and non-invasive tests. Invasive tests utilize endoscopic biopsy samples for histology culture, rapid urease test (RUT) and polymerase chain reaction (PCR). All these tests have been found to have sensitivity and specificity that are well above 90%. The non-invasive tests do not require endoscopy. These include urea breath test (UBT), immunoglobulin G and M serology, stool antigen test, saliva antibody test and urinary antibody test. Antibody test using either enzyme linked immune-sorbent Assay (ELISA) technique or immunochromatography test (ICT) technique ([11][26] [29]).

II. MATERIALS AND METHOD

STUDY AREA

The study was carried out at Decency Amana Medical Laboratory Karshi, Abuja, Nigeria. Karshi is a satellite town situated in Abuja Municipal Area Council in Federal Capital Territory Abuja, Nigeria. Karshi geographical coordinates are 8° 49’ 40” North, 7° 33’ 0” East. Karshi is about 38 km to Federal capital city of Abuja and 41 km from Karshi to Apo. Karshi has a population of about 30,000 people. The predominant tribe in Karshi is Gwandaras who constitute about 85% of the total population. Other minority tribes in Karshi are Gade,Gbagyi,Hausa,Fulani,Igbo,Idoma,andTiv ([32] [48] [49]).

STUDY POPULATION

The study was carried out among 204 clients between the aged 11 and 50 years attending Decency Amana Medical Laboratory Karshi Abuja. The study was carried out between September, 2019 and March, 2020.

QUESTIONNAIRE

The structured questionnaires were administered to consenting clients to obtained information on the age, gender, sources of drinking water and marital status prior to sample collection.

ETHICAL APPROVAL

Ethical approval informed consent was obtained from all the recruited clients. We obtained permission to carry out the study from the management of the Private Medical Laboratory.

SAMPLE COLLECTION

2 milliliters (2ml) of blood sample was drawn from each client aseptically by venipuncture and dispensed into sterile labeled anticoagulant free containers.

LABORATORY ANALYSIS

The Blood samples were centrifuged at 3000rpm for 5 minutes and the serum was collected for H.pylori test. Serum Anti-Helicobacter pylori Antibody was detected using a one – step H.pylori anti-body Rapid test cassette supplied by Global Device Biotech Co Ltd, China, according to the manufacturer instructions. The cassette were labeled with sample code for easy identification. Pastures pipette was used to drop about 2drop of serum on the cassette chamber and allowed for about 3-5 minute. The result is interpreted as the presence of two color bands (Test-T band and Control C band) within the result window regardless of which band appeared first indicated a positive result. The presence of only one pink color band within the result window indicated a negative result. The test was invalid if control line fail to appear or no distinct color line visible in both the test and control region.

STATISTICAL ANALYSIS

Chi square test was used to determine the level of significant between age, gender, educational background and marital status. P value <0.05 was considered significant at 95% confidence interval.

III. RESULT

This study showed that out of the 204 clients tested the overall prevalence of Helicobacter pylori was 120(58.8%).The distribution among the clients based on gender showed that male had the highest prevalence of 64(31.4%) and female 56(27.4%). Although the difference is not statistically significant association between sexes Table.1.

The distribution of Helicobacter pylori based on the age showed that high prevalence of 57(27.9%) was recorded among the age group 31-40years, followed by 21-30years, 41(20.1%) 41-50 years and 11-20 years had the least prevalence 10(4.9%). The result shows that there is no statistically significant relationship between the prevalence and age group Table.2.

The distribution of Helicobacter pylori according to marital status, the highest prevalence was recorded among the single individual 77(37.7%) and married had the least prevalence 43(21.1%). There was no statistical significant difference between the marital status in relation to Helicobacter pylori infection Table.3.

The distribution of Helicobacter pylori in relation to sources of drinking water by the client sampled. Those that used
sachet water had the highest prevalence rate 78(38.2%), followed by borehole water 30(14.7%), well water 10(4.9%), pipe borne water had the least prevalence 2(1.0%) and rivers/stream recorded zero prevalence of infection Table.4.

Table 1. Distribution of Helicobacter pylori Prevalence in relation to Gender

<table>
<thead>
<tr>
<th>S. No</th>
<th>Gender</th>
<th>No. Examined</th>
<th>No. Positive</th>
<th>Positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>118</td>
<td>64</td>
<td>31.4</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>86</td>
<td>56</td>
<td>27.4</td>
</tr>
<tr>
<td>3</td>
<td>Total</td>
<td>204</td>
<td>120</td>
<td>58.8</td>
</tr>
</tbody>
</table>

P-value <0.05 was considered as significant. P-value = 0.732

Table 2. Distribution of Helicobacter pylori Prevalence based on Age

<table>
<thead>
<tr>
<th>S. No</th>
<th>Age</th>
<th>No. Examined</th>
<th>No. Positive</th>
<th>Positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11-20</td>
<td>29</td>
<td>10</td>
<td>4.9</td>
</tr>
<tr>
<td>2</td>
<td>21-30</td>
<td>65</td>
<td>41</td>
<td>20.1</td>
</tr>
<tr>
<td>3</td>
<td>31-40</td>
<td>80</td>
<td>57</td>
<td>27.9</td>
</tr>
<tr>
<td>4</td>
<td>41-50</td>
<td>30</td>
<td>12</td>
<td>5.9</td>
</tr>
<tr>
<td>5</td>
<td>Total</td>
<td>204</td>
<td>120</td>
<td>58.8</td>
</tr>
</tbody>
</table>

P-value<0.05 was considered as significant. P-value = 0.307

Table 3. Distribution of Helicobacter pylori in relation to marital status

<table>
<thead>
<tr>
<th>S. No</th>
<th>Marital Status</th>
<th>No. Examined</th>
<th>No. Positive</th>
<th>Positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Single</td>
<td>130</td>
<td>77</td>
<td>37.7</td>
</tr>
<tr>
<td>2</td>
<td>Married</td>
<td>74</td>
<td>43</td>
<td>21.1</td>
</tr>
<tr>
<td>3</td>
<td>Total</td>
<td>204</td>
<td>120</td>
<td>58.8</td>
</tr>
</tbody>
</table>

P-value<0.05 was considered as significant. P-value = 0.997

Table 4. Distribution of Prevalence according to Source of drinking water

<table>
<thead>
<tr>
<th>S. No</th>
<th>Source of Drinking Water</th>
<th>No. Examined</th>
<th>No. Positive</th>
<th>Positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tap(Pipe borne)</td>
<td>7</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>2</td>
<td>Borehole</td>
<td>50</td>
<td>27</td>
<td>14.7</td>
</tr>
<tr>
<td>3</td>
<td>Well</td>
<td>26</td>
<td>10</td>
<td>4.9</td>
</tr>
<tr>
<td>4</td>
<td>Sachet water</td>
<td>121</td>
<td>81</td>
<td>38.2</td>
</tr>
<tr>
<td>5</td>
<td>Rivers/Stream</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Total</td>
<td>204</td>
<td>120</td>
<td>58.8</td>
</tr>
</tbody>
</table>

P-value<0.05 was considered as significant. P-value = 0.000

IV. DISCUSSION

This findings revealed that out of the 204 clients tested 120(58.8%) were positive for Helicobacter pylori infection. The prevalence of 58.8% in this study was lower than the 73.6% reported by [46] among patient in Zaria Metropolis, 93.3% reported by [47] among peptic ulcerative patients in Kano.80.4% reported by [34] in Kaduna, 93.6% reported by [36] among dyspeptic patients that underwent gastroscopy in Maiduguri North west, Nigeria.84.2% by [8], 71.7% by [5], Portugal and China. This report is also lower 73.9% in Pakistan [16] and reports of findings from other African Countries which have 74.8% Ghana, Kenya (71%) and Ethiopia 72% [6] [43] [45].

This is similar to the 58% obtained by [35] in Orlu, Imo State among duodenal and gastric ulcer patients, 51.4% reported by [11], 51.96% by [18].

This report is higher than 12.7% reported by [22] in Warri, Nigeria, 28.0% reported by [15] among undergraduate in Ilishan-Remo Nigeria. The difference could be explained as a result of difference in environmental factors that can, in turn lead to differences in transmission.

The prevalence of Helicobacter pylori infection with respect to gender was found high in male 64(31.4%) than the female 5(27.4%). There was no statistical significant between the sexes. This finding is in consistent with the finding of [18].

This disagreed with [22], and [11]; [15] and [46] who observed that H. pylori infection was higher in the females than males. This shows that sex is not a risk factor.

In relation to age high prevalence of 57(27.9%) was recorded among age group of 31-40years, followed by 21-30years 41(20.1%) and while those between 11-20years had the least prevalence rate of 10(4.9%). These findings disagreed with the report of [15] who reported that between the ages 21-25years had a greater prevalence and [18] who reported that higher among 50-59years. There is no significant statistical different age group and prevalence.

Prevalence according to marital status, there was high prevalence of Helicobacter pylori among single (37.7%) than the married (21.1%). There is no statistically difference between marital status and prevalence. This agreed with [15] who indicates prevalence in the single than the married. This may implies that marital status is not really a risk factor for Helicobacter pylori infection.

The distribution of Helicobacter pylori in relation to sources of drinking water shows that high infection rate recorded on sachet water (38.2%), followed by borehole water (14.7%) and pipe borne water had the least prevalence (1.0%). Stream/Rivers had zero prevalence. There is no statistical significant relationship.

This agreed with the findings of [11] that majority of the participants that are H. pylori positive consume sachet water and borehole water which could be contaminated as a result of improper processing of the sachets water, contamination by water vendors or inadequate drinking of the boreholes also more likelihood of fecal contamination of well, contrary to [46] who reported borehole with the highest prevalence.

Contrary to report of [9] who reported higher prevalence of H. pylori infection among subjects that sourced their drinking water from wells, stream and ponds when compared to those who use pipe-borne water.

Also, a similar study in Nigeria showed that sourcing water from well and borehole confers a higher risk of H. pylori infection the pipe-borne water [22]. Another study by [33] from Kazakhstan found high prevalence of H. pylori infection among subjects who use the river and well water for drinking compared
to those who use tap water. In another study [19] found anti-
H. pylori antibody in surface and shallow ground water samples
tested in the USA and concluded that the route of transmission for
H. pylori is also waterborne.

V. CONCLUSION

This study recorded a higher prevalence rate of Helicobacter pylori infection among clients Attending Private Medical Laboratory in Karshi Abuja, Nigeria. It recommended the reduction in Helicobacter pylori infection could be achieved by public health enlightenment campaign on Helicobacter pylori causes and prevention should be promoted and strengthened. Provision of clean portable drinking water will significantly reduce the burden of the infection. An integrated approach involving all stakeholders on health should be adapted with inclusion of private medical laboratory into government health policies on Helicobacter pylori.

VI. ACKNOWLEDGEMENT

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Impact of Climate Change on Schizophrenia Patients with Sex Stratifications: Variability of Temperature and Relative Humidity Effects

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Abstract- The impact of temperature and relative humidity on sex differences among schizophrenia patients at Neuropsychiatric Hospital, Akure, and Ondo State, Nigeria was examined in this paper. Two independent variables (temperature and relative humidity) and one dependent variable (number of schizophrenia patients that visited the hospital from (2010–2017) data were collected. The population of study was 13,834 (in-patients and out-patients) for the period of eight years; that comprised 7,290 (52.70%) female and 6,544 (47.30%) male schizophrenia patients. The collected data were analyzed with the use of single regression and multivariate regression analyses. This study therefore, found that climate parameters: relative humidity and temperature had overlapping effects on the number of male and female schizophrenia patients that consulted at the hospital. It was found that increase in temperature had negative association with the number of schizophrenia patients i.e., both sexes were vulnerable to the risk of schizophrenia (mental ill-health); and that the number of female schizophrenia patients recorded for the eight years was higher in number compared to the male schizophrenia patients. It was also observed that the vulnerability of males to the risk of schizophrenia with reference to relative humidity increased and differed from the female vulnerability. This is an indication that other factors - bio psychosocial, environmental, culture etc. may not have made male and female population equally vulnerable at the risks of schizophrenia. The probability that the male population is more vulnerable to the risk of schizophrenia cases as relative humidity and overlapping effect increases is 0.13 and 0.22 respectively for male while that of female is 0.12 and 0.15 respectively. The number of schizophrenia patients diagnosed and traced with reference to relative humidity and overlapping effect was 2,041 females and 3,099 males; 2,019 females and 1,718 males respectively. This might be due to the fact that: male patients respond to treatment very slowly as compared to females; the recovery period of males with schizophrenia was longer than for females; consequently, the rate of discharge from hospital for male schizophrenia patients was lower than the discharge of the female schizophrenia patients; the cognitive deficits and memory delay was more in male schizophrenia patients than the female. Therefore, all these can aggravate as relative humidity increases coupled with the: risk of psychoactive substance use; the protective effect of estrogen is lower in male than female; psychoactive substance consumption rate is higher in male than in female. Also, increasing rate of schizophrenia is caused as relative humidity increases because testosterone reduction in male occurs during hot weather, and reduction in the brain gray matter in male tend to reduce neuron density.

Index Terms- Temperature, Relative Humidity, Overlapping Effect and Sex Distribution of Schizophrenia Patients

I. INTRODUCTION

Schizophrenia was introduced at the beginning of this century as a term into the medical language by the Swiss psychiatrist Bleuler. Schizophrenia is a major mental disorder, or a group of disorders with unknown causes that involves a complex set of disturbances of perception, thinking and social behavior. It has been discovered that no culture or society in the world is free from schizophrenia, and evidence states that this illness is a serious public health problem (Barbato, 1998). Also, according to Aleman (2014) schizophrenia belongs to the most severe psychiatric disorders and it is characterized by hallucination, delusions, cognitive impairment, blunted emotion, disordered thinking, and social withdrawal accompanied by intellectual disturbances and other emotional behaviors. Aleman explained further that patients with schizophrenia suffer from significant deficit in attention, memory, executive functioning, and general intellectual abilities and these can be manifested in such manners as having difficulty to: think clearly; distinguish reality from fantasy; react in an emotionally inappropriate way; and to interact with others. Schizophrenia is often associated with dopamine imbalances in the brain (Encyclopaedia Britannica, 2020). Characteristics of schizophrenia are of two different types:

Type 1- Positive Symptoms: This is characterized with things such as delusions, hallucinations and paranoia. Patients may experience things such as hearing voices, which are often said to be from God or devils.

Type 2- Negative Symptoms: This is characterized with or shows more of catatonic behavior. Patients exhibit a loss of
drive, lack of emotion or catatonic stupor. Catatonic simply mean not able to move or show any reaction to things because of mental illness especially schizophrenia, in which a person does not move for long periods.

Hafner (2002) compared clinical subtypes, analyzed symptomatology, type of illness onset and course from the first sign to the climax of the first episode. The three types of onset: acute, subacute, and chronic; and three categories of initial symptoms: positive, negative and unspecified. Although, patients can be diagnosed with both types 1 and 2 symptoms. When this happens, it is been categorized as disorganized as they will exhibit disorganization, even in speech.

Recent studies have shown that environmental factors might be involved in the development of schizophrenia. The importance of these factors has been demonstrated by the fact that in monozygotic twins discordant for schizophrenia, environmental variations might have resulted in inter-individual differences and that current etiological models regarding the pathogenesis of this disease propose interactive effects between multiple genes and environmental factors (Fernanda et al., 2009). Although various theories of the origin of schizophrenia have centered on anatomical, biochemical, psychological, social, genetic and environmental causes, but evidence strongly shows that a combination of genetic and environmental factors play an important role in the development of the condition. There is a 1% chance of developing schizophrenia if neither of the parents carries the gene, however this increases to 20% if one of the parents had positive history of schizophrenia, and increases to 46% if both parents had exhibited positive acts of schizophrenia.(any authority)?

According to Shiloh et al. (2005a) the potential effects of climate on the severity of schizophrenia symptoms are not well established while some data suggest higher summer admissions of schizophrenia patients to psychiatric facilities and other data state that there are various factors (e.g. stress of vacation, family being away, staff away, least support in community and health services) that increased patients admission in hospitals. Specific climatic factors (ambient temperature, relative humidity and photoperiod) are assumed to contribute to the emergence of psychotic exacerbation and increased summer admissions. Most of these studies grouped together schizophrenic and affective psychoses, thus excluding an analysis of their potentially distinct admission patterns. Hence in this study, it is hypothesized that various climatic factors may contribute to the emergence of psychosis in schizophrenia patients and consequently may increase their admission rates to psychiatric hospitals.

Schizophrenia was among disorders that were associated with increased frequency of heat-related-illness (HRI) hospitalization among mental illness and behavioral disorder (MBD) patients. Increased risk of mental behavioral disorder (MBD) was observed in males. Previous studies outside U.S have found that dementia and schizophrenia are significant factors for heat-related-illnesses (Schmeltz and Gamble, 2017). Shiloh et al., (2005b) found that mean monthly admission rates were significantly higher during the summer for schizophrenia patients and the fall season for schizo-affective patients. Schizophrenia patients’ mean maximal monthly environmental temperature correlated with mean monthly admission rates. This equally indicates that persistent high environmental temperature may be a contributing factor for psychotic exacerbation in schizophrenia patients and their consequent admission to mental hospitals.

Extreme warming affects schizophrenia, but cooling does not (Aleman et al., 2016) and extremely high diurnal temperature range (DTR) is a potential trigger for schizophrenia admission in Hefei, China (Zhao et al., 2016). According to Lee et al. (2017), mental illness is important to consider among risk factors for heat-related morbidity with increased hospital admissions during extreme heat events and that there are numerous studies from Australia, Canada, Israel and other countries examining the association between high temperature and hospitalization related to mental-behavioral-disorder indicating an increased risk temperature related death and hospitalization especially among those with dementia and schizophrenia. Several studies have identified more cases of patients with schizophrenia in the summer. Research has shown a seasonal influence on first admission for schizophrenia (in the Northern Hemisphere including Ireland, England and Scotland) and the peak time of the hospital entries for mental disorders occurred more about the middle of the year (Amr et al., 2012; Shiloh et al., 2009). There was significant relationship between higher ward temperature and more severe symptoms among in-patients with schizophrenia from the research conducted in Israel (Shiloh et al., 2009).

When considering the schizophrenia symptoms and onset of the illness, Hafner (2002) stated that most studies reported a greater frequency of positive and affective symptoms for women and more negative symptoms and insidious types of onset for men. According to Li et al. (2017), men with schizophrenia appear to have more negative symptoms and more severe clinical features than females, particularly in social withdrawal, substance abuse and blunted or incongruent effects. Women with schizophrenia often have more mood disturbances, depressive symptoms and affective symptoms. In the case of sex differences in the onset of the illness, Ochoa et al., (2012) wrote, men usually develop the illness at age 18-25, while in women, the mean age of onset is 25-35 and that women seem to have two peaks in the age of onset of the diseases; the first after menarche and the second when they are over 40. According to Li et al. (2017), men have single peak age for onset which is between 21-25 years old and women have two peaks age of onset, one between 25 and 30 years old and another is after 45 years old. Aleman (2003) acknowledged that in younger age groups, the risk is higher for men and that beyond age 40 years and perhaps even earlier, the risk is higher for women, but according to Hafner (2002), there are steep increase with a maximum between 15 and 25 years for men and after that a monotonous decrease to a very low level. While in women the rate of onsets rose slightly less steeply and reached a lower and broader peak in age band 15 to 30. After a decline, female onset reached a second somewhat smaller peak in age group 45 to 50 around pre-menopause with significant difference to men. The three researchers and their group Ochoa, Li, Hafner and Aleman showed that men have single peak and women have two peaks. The peaks differences can be suggested to be in the physiological and psychological operational differences in relating to body chemical and biological functions, and their interaction with environmental and social elements.
According to Hafner (2002), normal early childhood development differs very little between the sexes. In the late childhood, boys exhibit more externalizing behaviors and a slightly higher frequency of attention deficits, and girls have more anxiety from puberty. Therefore, the mental health risks of males and females follow different lines, males show a greater frequency of hyperactivity, attention deficit disorder, dissocial behavior, aggressiveness and anti-social personality disorder, while females show greater frequency of anxiety and affective disorders. Externalizing disorders including antisocial behavior and substance abuse are more frequent in men, while internalizing disorder including anxiety and depression are more frequent in women.

Adult-onset schizophrenia is preceded by mild neuromotor, cognitive and behavior anomalies. In the minors, early childhood deficits in neuromotor and speech development as antecedents of schizophrenia seem to occur at the same frequency in boys and girls, but the behavioral anomalies manifest themselves several years later in girls than in boys most especially from the school age. The severities of these anomalies are more in children of mothers with schizophrenia and boys clearly score higher than girls on cognitive impairment.

III. DATA REPORT AND ANALYSIS

3.1 Data Presentation

| Table 1: Numbers of Male and Female Schizophrenia Patients, temperature and Humidity |
|-----------------------------------------------|-----------------|-----------------|
| Sex                                           | Climate Parameters |
| 2010-2017 Numbers of male Schizophrenia Patients | 2010-2017 Numbers of Female Schizophrenia Patients | Temperature | Humidity |
| Jan | 460 | 508 | 24.50 | 76.75 |
| Feb | 510 | 518 | 25.88 | 82.87 |
| March | 424 | 586 | 26.25 | 86.30 |
| April | 489 | 561 | 26.13 | 88.13 |
| May | 661 | 713 | 25.71 | 89.80 |
| June | 611 | 596 | 24.96 | 90.02 |
| July | 483 | 693 | 24.32 | 89.36 |
| August | 733 | 627 | 24.11 | 88.70 |
| September | 591 | 546 | 24.50 | 89.53 |
| October | 603 | 713 | 25.13 | 89.24 |
3.2 Data Analysis

3.2.1 Single Regression Analysis

Table 2: Data from STATA Regression Analysis

<table>
<thead>
<tr>
<th>Single Regression Analysis: Individual Parameters</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>-37.59825</td>
<td>11.00063</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>-11.65608</td>
<td>7.233106</td>
</tr>
<tr>
<td>Coefficient</td>
<td>0.331</td>
<td>0.059</td>
</tr>
<tr>
<td>P</td>
<td>-1.02</td>
<td>2.13</td>
</tr>
<tr>
<td>T</td>
<td>0.0944</td>
<td>0.3119</td>
</tr>
<tr>
<td>R (Coefficient of Correlation)</td>
<td>-0.31</td>
<td>0.56</td>
</tr>
<tr>
<td>CI</td>
<td>[-119.6345, 44.43797]</td>
<td>[-0.5116661, 22.51293]</td>
</tr>
<tr>
<td>Number of Patient based on % of Determination</td>
<td>618</td>
<td>2041</td>
</tr>
<tr>
<td>Number of Patients</td>
<td>6544</td>
<td>6544</td>
</tr>
</tbody>
</table>

From table 2 above:

**Male Schizophrenia Patients**

- Temperature as a parameter in this study had a negative impact. The coefficient for temperature shows that an increase in temperature resulted to 37.60 decrease in number of male schizophrenia patients but was statistically not significant with confidence interval [-119.635 44.4438] i.e. the reduction in the number of male schizophrenia patients may be as much as 120 or there could be an increase in number of male schizophrenia patients as low as 44 as the temperature increased. This decrease in the number of male schizophrenia patients due to increase in temperature is not statistically significant because p (0.331) > 0.05 and the t (1.02) < 2.04. The amount of reduction in number of male schizophrenia patients is 9% (i.e. R^2). Increase in the temperature reduced the number of male schizophrenia patients with 9% of 6544 which equals 618. The negative coefficient of correlation r (0.31) is weak.

The relative humidity parameter comparatively had a positive effect. The coefficient for relative humidity shows that an increase in relative humidity resulted to 11 decrease in number of male schizophrenia patients but statistically not significant with confidence interval [-0.5117 22.5129] i.e. the reduction in the number of male schizophrenia patients may be as less as 1 or there could be an increase in number of male schizophrenia patients was raised to 23 when relative humidity increased. This increase in the number of male schizophrenia patients due to increase in the relative humidity is not statistically significant because p (0.06) > 0.05. The increase in the number of male schizophrenia patients was 31.19% (i.e. R^2). Increase in relative humidity increased the number of male schizophrenia patients by 31.19% of 6,544 which equals 2,041. The positive coefficient of correlation r (0.56) between increase in the relative humidity and the number of male schizophrenia patients is moderate.

**Female Schizophrenia Patients**

- The temperature parameter also had a negative effect on the female patients. The coefficient for temperature shows that an increase in temperature resulted in 11.656 decrease in the number of female schizophrenia patients but statistically not significant
with confidence interval [-76.354 53.042] i.e. the reduction in the number of female schizophrenia patients may be as much as 76 or there could be an increase in number of female schizophrenia patients as low as 53 as temperature increased. This decrease in the number of female schizophrenia patients due to increase in the temperature was not statistically significant because p (0.697) > 0.05 and the t (-0.4) < 2.04. The amount of reduction in number of female schizophrenia patients is 1% (i.e. R²). Increase in the temperature reduced the number of female schizophrenia patients with 1% of 7,290 which equals 116. The negative coefficient of correlation r (0.31) is very weak.

The relative humidity parameter impacted positively. The coefficient for relative humidity showed that an increase in relative humidity resulted in 7.233 decrease in number of female schizophrenia patients but statistically not significant with confidence interval [-1.946 16.412] i.e. the reduction in the number of female schizophrenia patients may be as less as 2 or there could be an increase in number of female schizophrenia patients as high as 16 as relative humidity increases. This increase in the number of female schizophrenia patients due to increase in the relative humidity is not statistically significant because p (0.11) > 0.05 and t (1.76) <2.04. Increase in the number of female schizophrenia patients was 23.56% (i.e. R²). Increase in the relative humidity increased the number of female schizophrenia patients with 23.56% of 7,290 which equals 1,718. The positive coefficient of correlation r (0.49) between increase in the relative humidity and the number of female schizophrenia patients was moderate.

### 3.2.2 Multivariate Regression Analysis:

<table>
<thead>
<tr>
<th>Table 3: Data from STATA Regression Analysis</th>
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<tbody>
<tr>
<td><strong>Multivariate Regression Analysis: Individual Parameters</strong></td>
</tr>
<tr>
<td>Year</td>
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<tr>
<td></td>
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<tr>
<td>2010</td>
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<td></td>
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<tr>
<td>Constant (intercept)</td>
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<tr>
<td></td>
</tr>
<tr>
<td>% of Determination</td>
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<tr>
<td>Number of Patients</td>
</tr>
</tbody>
</table>

**From Table 3 above:**

**Male Schizophrenia Patients**

In the overlapping process, the coefficient for temperature showed that an increase in temperature resulted in 49.847 decrease in the number of male schizophrenia patients but it was statistically not significant with confidence interval [-117.550 17.967] i.e. the reduction in the male schizophrenia patients may be as much as 118 or there could be an increase in the number of male schizophrenia patients as low as 18.
The effect of the two independent variables on the number of the male schizophrenia patients were not the same i.e. increase in the temperature has negative impact on the number of male schizophrenia patients, because the magnitude of the decrease in the number of male schizophrenia patients due to the increase in temperature was more than the magnitude of the increase in the number of male schizophrenia patients and increase in the relative humidity has positive impact on the number of the male schizophrenia patients, because the magnitude of the increase in the number of the male schizophrenia patients due to the increase in relative humidity is more than the magnitude of the decrease in the number of male schizophrenia patients.

In the overlapping processes, the increase in the relative humidity increases the number of male schizophrenia patients positively than the increase in temperature.

The multivariate regression analysis yielded overlapping effect with the value of the intercept at vertical axis of positive confidence interval 737.971-[1071.717 2547.659]. The intercept on the number of patients axis (vertical axis) for the two parameters shows that an increase in the two parameters gave as much as 738 increase in the number of male schizophrenia patients, and a decrease in the number of male schizophrenia patients was as low as 1.072 or there could be an increase in the number of male schizophrenia patients as much as 2.547 but was statistically not significant with p (0.380) > 0.05 and t (0.92) < 2.04. The overall impact of the overlapping effect of the increase in the two parameters impacted positively i.e. the magnitude of increase in the number of male schizophrenia patients due to increase in the two parameters was more than the magnitude of decrease in the number of male schizophrenia patients. Also, F (4.049) > t (2.04) and F carried positive value. The overlapping effect of the increase in the two independent variables therefore, increased the number of male schizophrenia patients. However, there was an increase in the overlapping effect of the two parameters increase the number of male schizophrenia patients by 47.36% (from R²). The increase in the number of male schizophrenia patients due to overlapping effect was 47.36% of 6544 which equaled 3099.

Female Schizophrenia Patients

In the overlapping process, the coefficient for temperature showed that x increase in temperature resulted in 19.364 decrease in the number of female schizophrenia patients, but was statistically not significant with confidence interval [-79.436 40.708] i.e. the reduction in the female schizophrenia patients may be as much as 79 or there could be an increase in the number of female schizophrenia patients as low as 41. 

In the overlapping process, the coefficient for relative humidity showed that an increase in relative humidity will resulted to 7.233 increase in the number female schizophrenia patients, but was statistically significant with confidence interval [-1.938 17.404] i.e. the reduction in the number of female schizophrenia patients was as low as 2 or there could be an increase in the number of the female schizophrenia patients as much as 17. 

The effect of the two independent variables on the number of the female schizophrenia patients were not the same i.e. increase in the temperature has negative impact on the number of the female schizophrenia patients, because the magnitude of the decrease in the number of the female schizophrenia patients due to increase in temperature is more than the magnitude of increase in the number of the female schizophrenia patients; and the increase in the relative humidity had positive impact on the number of the female schizophrenia patients, because the magnitude of the increase in the number of the female schizophrenia patients due to the increase in relative humidity was more than the magnitude of the decrease in the number of the female schizophrenia patients.

In the overlapping processes, the increase in the relative humidity increases the number of female schizophrenia patients positively than the increase in temperature.

The multivariate regression analysis yielded overlapping effect with the value of intercept at vertical axis of positive confidence interval 427.1854[-1175.906 2030.277]. The intercept on the number of patients’ axis (vertical axis) for the two parameters shows that an increase in the two parameters will lead to 427 increase in the number of female schizophrenia patients and that the decrease in the number of female schizophrenia patients could be as less as 1180 or there could be an increase in the number of female schizophrenia patients as much as 2030; but statistically not significant with t: 0.60, P > (t): 0.562 or P (0.562) > 0.05 and t (0.60) < 2.04. The overall impact of the overlapping effect of the increase in the two parameters is of positive impact i.e. the magnitude of increase in the number of female schizophrenia patients due to the increase in the two parameters was more than the magnitude of decrease in the number of female schizophrenia patients. Also, F (1.735) > t (2.04) and F carried positive value. The overlapping effect of the increase in the two independent variables increases the number of female schizophrenia patients. The increase in the overlapping effect of the two parameters increased the number of male schizophrenia patients by 27.83% (from R²). The increase in the number of the male schizophrenia patients due to overlapping effect is 27.83% of 7290 which equals 2.029.

IV. FINDINGS

In table 2 above, although temperature contributed nothing to increase the number of schizophrenia patients in both sexes, the rate at which the number of male schizophrenia patients decreased as the temperature increased was higher than the rate at which the number of female schizophrenia patients decreased. Notwithstanding the number of male and female schizophrenia patients have negative association with increase in temperature. In other words, none of 6544 and 7290 total numbers of male and female schizophrenia patients respectively attributed to the increase in temperature. None of the diagnoses were traceable to increase in temperature. Male and female schizophrenia patients visiting the Neuropsychiatric Hospital, Akure, Nigeria between 2010 and 2017 did not result from increase in temperature.

It can be deduced therefore that increase in relative humidity increased the number of schizophrenia patients visiting the hospital in both sexes. The number of male and female schizophrenia patients had strong correlation (in terms of their correlation coefficients) with increase in relative humidity, but
the rate at which schizophrenia psychiatric cases per unit relative humidity spread among males was more than the females. Even, t (2.13) for males was greater than t (1.76) for females. Increase in the relative humidity made male population more vulnerable to the risk of schizophrenia psychiatric cases than the female population. There were four parameters that really showed that the male schizophrenia patients were more than the female patients as the relative humidity increased. The four parameters are:

- The t-value where t (male) > t female).

- The correlation coefficients r: where r (0.56)-male > r (0.49)-female.

- The Confidence Interval, CI: was checked and the width ( ) of the lower and upper interval or the distance from the point of the upper interval from the lower interval in magnitude was only CI: (23.025)-male > (18.359)-female.

- The number of patients based on the % of determination male (2041) > Female (1718).

From Table 3 above, the multivariate regression analysis gives the overlapping effect of the two independent variables

In the overlapping process, the major factor that contributed to the elevated number of male and female schizophrenia patients in hospital was increase in relative humidity because the number of male and female schizophrenia patients had positive coefficient i.e. male and female schizophrenia patients have positive association with relative humidity as the parameters are in overlapping process. The effective strength of the increase in the relative humidity was more the males than the females in the overlapping processes and this is established from t (2.55)-male > t (1.81)-female. The overall event of the overlapping effect of the two independent variables on the number of male and female schizophrenia patients showed positive association with the number of schizophrenia patients visiting the hospital, and this is also established from the F-value that shows positive sign. The strength effect of the overlapping of the two-independent variable of interest is more on the male than the female and is established from:

- F (4.05)-male > F (1.74)-female.

- At the intercept: t (0.92)-male > t (0.60)-female.

- At the intercept-Y-axis: Number of schizophrenia patients for male (738) and female (427).

- At the intercept-Y-axis, CI: The number of male schizophrenia patients can be reduced to as less as 1,072 and can be increased to as much as 2548 while the number of female schizophrenia patients can be reduced to as less as 1176 and can be increased to as much as 2030.

The reduction in the number of the female schizophrenia patients is more than the reduction in the male schizophrenia patients.

The increase in the male schizophrenia patients is more than the female schizophrenia patients.

Combining the two above shows that the number of the male schizophrenia patients will be more than the number of the female schizophrenia patients.

- % of Determination: The number (3099) of the male schizophrenia patients is more than the number (2029) of the female schizophrenia patients as the overlapping effect increases.

V. DISCUSSION OF FINDINGS

The number of schizophrenia patients visiting the hospital from 2010-2017 were more of female (7290) than male (6544), while the total is 13834. The probability that the schizophrenia patients were male is 0.47 and the probability that the schizophrenia patients were female is 0.53. When all possible factors that can cause schizophrenia mental illness are considered, the female populations are discovered to be more vulnerable to the risk of schizophrenia cases than male. It can be that the relative risk or incidence risk of female population is equivalent to 1.13 compared with the male population visiting Neuropsychiatric Hospital, Akure, Nigeria in respect of the factors behind the schizophrenia cases.

The sex differences have been attributed to biological, psychosocial, and cultural factors (Novick et al., 2016) called biopsychosocial causes of the sex differences (Falkenburg and Tracy, 2012). It is also believed that the biopsychosocial and cultural differences can make each sex (male and female) respond differently to environmental factors e.g. climate change (temperature and relative humidity). The number of patients visiting the hospital from table 1 was recorded based on the combination of many factors and the records shows that female schizophrenia patients were more than male patients, but with specific factors such as climate change (temperature and relative humidity as the two parameters of interest), it was discovered that male schizophrenia patients diagnosed were traced to relative humidity and were more than the female patients. While the increase in temperature made no contribution to the number of schizophrenia patients (in either male or female) from the regression analysis; the overlapping effect does make both sexes vulnerable to the risk of schizophrenia cases. From the regression analysis and overlapping effects of the two independent variables, it is seen that different factors can make male or female schizophrenia patients more vulnerable at the risk of schizophrenia cases than the other.

The total schizophrenia cases diagnosed and traced to climate change was 3,759 from single regression analysis; it comprised 2,041-male and 1,718-female while the total number of schizophrenia patients visiting the hospital for a period of eight years (2010 to 2017) was 13834. None of the male or female schizophrenia patients were traced to increase in temperature. The contribution of increased temperature as a separate entity was zero.

- The probability that temperature (T) makes male (M) population vulnerable at the risk of schizophrenia mental illness out of all schizophrenia patients visiting hospital for eight
years was \( (\cdot) = 0 \); and the probability that relative humidity (RH) makes male population vulnerable at the risk of schizophrenia mental cases is \( (\cdot) = 0.13 \). The probability that temperature or relative humidity makes male population vulnerable to schizophrenia cases is \( (\cdot) + (\cdot) = 0.13 \) mainly from the diagnosis that was traced to increase in the relative humidity.

- The probability that temperature (T) makes female (F) population vulnerable at the risk of schizophrenia mental illness out of all schizophrenia patients visiting the hospital for eight years is \( (\cdot) = 0 \); and the probability that relative humidity (RH) makes female population vulnerable at the risk of schizophrenia mental cases is \( (\cdot) = 0.12 \). The probability that temperature or relative humidity makes male population vulnerable to schizophrenia cases is \( (\cdot) + (\cdot) = 0.12 \) mainly from the diagnosis that was traced to increase in the relative humidity.

The probability that the male populations are vulnerable to the risk of schizophrenia cases is higher than the female probability as climate changes is an indication that male populations diagnosed and traced to climate change are more. The effective strength of relative humidity is more on male than female in schizophrenia cases.

(M) This is evident in the overlapping effect. The probability that overlapping effect (OE) makes male population vulnerable to the risk of schizophrenia mental illness out of all schizophrenia patients visiting hospital for eight years is \( (\cdot) = 0.22 \) and the probability that overlapping effect (OE) makes female (F) population vulnerable at the risk of schizophrenia mental illness out of all schizophrenia patients visiting hospital for eight years is \( (\cdot) = 0.15 \).

The followings can be considered to be the reasons why males in the population were more vulnerable to schizophrenia than female population as relative humidity increases are:

- According to Novick et al. (2016), women tend to have higher rates of response, remission, and recovery; lower rates of hospitalization, shorter lengths of stay, longer time of relapse and better social adjustment than men. It can be agreed upon that the rate at which women have been discharged in the hospital is more than men. The population of male are more at a particular time than female as relative humidity increases, since women responded to treatment than men. Women patients with schizophrenia mental cases reduced rapidly than men. Women with schizophrenia therefore have a more favorable course and outcome than men.

- Male schizophrenia patients had more serious cognitive deficits than females in immediate and delay memory (Li et al., 2017), and increased relative humidity and heat stress are observed to significantly impair complex cognitive tasks such as working memo that even worsen insomnia (Cooper, 2018).

- Lack of estrogen protective effect in males can be aggravated with increase in relative humidity, and this can make males to develop the most severe form of schizophrenia disorder early than female. Estrogen plays possible neuroprotective roles against schizophrenia pathology in women. In the microgravity and higher radiation environment where there is possibility of increased relative humidity, estrogen activities can be on decrease, this estrogen deficiency has been found to be highly related to severity of psychiatric symptoms in women during menopause and that during menstrual cycle female schizophrenia patients often have severe symptoms in the low estrogen phase of their menstrual cycle (Li et al., 2017).

- Since the consumption of substance abuse is on the increase as relative humidity and temperature increases, substance abuse presents a higher prevalence in people with schizophrenia and first-episode psychosis; and as the rate at which male population is vulnerable at the risk of schizophrenia cases increase as relative humidity increases. This is an evidence that males consume more psychoactive substance than females; and that men are more vulnerable to the risk of psychoactive substance than female as relative humidity increases (Jaiyeola et al., 2020). Men present higher levels of cannabis, cocaine, hallucinogen consumption and case of alcohol abuse more than women (Hafner, 2002). The percentage of current alcohol or substance abuse was also generally lower in females than in males across all region (Novick et al., 2016).

- One of the symptoms of schizophrenia is frequent hyperactivity and higher frequency of aggressive behaviors, in particular antisocial aggression which is more in display in men than women (Hafner, 2002), most especially men with psychoactive substance use as temperature and relative humidity increases.

- Sex differences in hormone, chromosome, brain structure and activities might bring difference in response to ambient relative humidity and temperature resulting into difference in schizophrenia symptom effect such as negative and positive symptoms. Reduction in the testis weight and testosterone that was found in human during flight and post flight. Without gravity the testes would sit closer to the body and without any air convection they would be at a higher temperature, which could impair sperm production in mammals. In other words, increase in temperature and relative humidity can decrease testosterone; and it was discovered that schizophrenia patients with low levels of testosterone often predominantly have negative symptoms and serum testosterone levels associated with greater severity of negative symptoms of schizophrenia (Li et al., 2017) in men. Reduction in oxytocin levels that is responsible for production functions can be found to develop negative schizophrenia symptoms while schizophrenia with higher levels of plasma oxytocin develop fewer psychotic symptoms. This oxytocin can be impaired as temperature and relative humidity increases such as in microgravity and higher radiation environment.

- Male’s brain has more white matter and female’s brain with more grey matter (Costendi, 2013) and it was discovered
that there are 25% loss of gray matter in certain areas of schizophrenia brain (Gluck, 2019). In other words, persons with schizophrenia have reductions in gray matter in these brain regions (Kara Rogers, 2020). Reduction in gray matter in turn reduce the neurons density; and since the volume of the brain increases with increase in temperature or relative humidity while density decreases. It can be agreed upon that increase in temperature and relative humidity can decrease the level of gray matter that reduces the density of the synapses or connections between the neurons; since the male has less gray matter than the female, and male gray matter and neurons density further reduces with increase in relative humidity than female gray matter. It is also expected that the males with schizophrenia cases should be more than the females as the relative humidity increases due to reduction in the male’s brain gray matter, as the synapses responsible for neurons communication with one another enhance cognition, memory formation and storage, and information processing. It has been discovered that the loss of neuron or synapses density due to reduction in gray matter has been more in males than females; this leads to cognition deficits, memory delay, declines in decision-making ability and generally negative schizophrenia symptoms in males than in females.

VI. CONCLUSION

There are positive association between the number of male/female schizophrenia and increase in relative humidity while increase in temperature contributed nothing to the increase in the number of male and female schizophrenia patients. According to table 1, the number of female schizophrenia patients is more than the male schizophrenia patients, but the analysis with single and multivariate regression analysis shows that male population were more vulnerable at the risk of schizophrenia cases as relative humidity increases than female population. Factors such as biopsychosocial, environmental, and culture may not actually make male and female population equally vulnerable to the risk of schizophrenia or generally mental ill-health. In this study, the number of schizophrenia patients diagnosed and traced to increase in relative humidity and overlapping effect to be respectively 2041 and 3099 males and 1718 and 2019 females. This might be due to the fact that:

- Male respond to treatment very slow compared with female; the recovery period of male with schizophrenia is longer than the female; and the rate of discharge of male schizophrenia patients from the hospital is lower than the discharge of the female schizophrenia patients.

- The cognitive deficits and memory delay are more in male schizophrenia patients than the female, these can aggravate as relative humidity increases coupled with the risk of psychoactive substance use.

- The protective effect of estrogen is lower in male than female.

Psychoactive substance consumption rate is higher in male than in female, and can also be at increasing rate of effect as relative humidity increases.

Testosterone, brain gray matter and neuron density reduction during hot weather or humidity are more in male than female schizophrenia patients.

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Strategic Vision And Mission Practices On Service Delivery In Rwanda Development Board

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Abstract- Over the past decade strategic vision and mission practices are important to the strategic plan implementation of any organization specifically in public sector where it comes to service delivery. Public organizations in Rwanda spends much time and effort on their formulation as they aren’t used as planning instruments. The purpose of the study was to examine the influence of strategic vision & mission practices on service delivery in Rwanda Development Board. This study adopted a descriptive approach. The study target population was 114 employees from Rwanda development Board. A sample of 89 respondents was determined using Slovin’s formula which was stratified into three strata: top management staff, middle management staff, and low-level management staff. Census method brought out the aspect of accuracy and reliability to this study, because, each and every individual participated to this study. The study findings indicated that the coefficient of Strategic vision & mission practices was 0.099 which was greater than zero. The t statistic of this coefficient is 2.124 with a p value of 0.034 which is less than 0.05. This implies that the coefficient 0.099 is significant. Since the coefficient is significant, it shows that Strategic vision & mission practices making has a significant influence on service delivery at Rwanda Development Board. The study concludes that employee skill development, mentorship, delegation and motivation should be embraced for enhanced service delivery. The study recommends that the Rwanda Development Board should partner with training consultancy organizations such as universities to equip employees with relevant skills by conducting periodical needs assessment.

Index Terms- Strategic vision and mission practices, Service delivery, Rwanda Development Board

I. BACKGROUND OF THE STUDY

Strategy implementation involves both operationalization and institutionalization of strategy. Operationalization is concerned with turning strategic intent into operational reality. Boggis and Trafford (2014) argue that there is often more to operationalizing strategy than making structural changes, redesigning processes and training staff. They assert that for strategies to be truly successful, leaders need to create the conditions that enable the organization to pull itself into an improved future, a future that not only reflects the strategic intent, but also becomes operational reality. For this to happen, institutionalization must occur.

According Daft (2010) concept on strategy implementation has continued to evolve in competitive organization. A number of factors that have been pointed out by acknowledged scholars like Thompson, Gamble and Strickland (2012) which determine strategy implementation in an organization are employee development, leadership and structure. Development of employee skills and knowledge through trainings can promote creativity and the flexibility of implementation new policies or plans formulated. Delegation and job appraisal among workers can enable the organization identify key competencies among workers that can lead to strategy implementation thus firm performance (Efendioglu & Karabulut, 2010). John and Richard (2011) argues that leadership and strategy implementation are directly correlated in organization context. Visionary leaders are always keen on creating a platform that will promote team spirit in an organization thus strategy implementation (Konzi, 2012). The ability of leaders to formulate policies that will promote synergy among workers and drive them to work towards organization goals is the fundamental aspect of any successful organization. In addition, organizations that continuously review their operational structures are more likely to enhance efficiency and effectiveness in service delivery. Organizations with organic structures and more likely to implement strategies more effectively compared to organizations with mechanistic structures (Kinyanjui & Juma, 2014).

Building on the investment law of 2006, the GOR established Rwanda development board (RDB) in 2008 to fast track development projects and to facilitate new investment. RDB consolidates several Agencies previously involved in promoting investment including the Rwanda investment and export promotion Agency, the Rwanda commercial registration service Agency, the human and institutional capacity development Agency, the Rwanda information and technology agency, and the Rwanda office of tourism and national parks (Affairs, bureau of economic and business development report, 2012)

In this regard, governments realized RDB as a critical and strategic tool with potential to provide efficient and effective services and generally improve government operations (Bizimana, 2012). Consequently, the government of Rwanda embraced began anticipation on increasing efficiency, effectiveness, transparency, simplify procedures, improve record management, reduce corruption and enhance attitudinal change. Further, RDB aims at shifting from the silo mentality, bureaucratic, and paper-based transactional approach towards electronically propelled systems to develop participation, accountability, transparency and accessibility. Its against this background that the study will

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investigate the influence of strategic plan implementation practices on service delivery in public sector in Rwanda: a case of Rwanda Development Board.

II. STATEMENT OF THE PROBLEM

Over the years the government of Rwanda has experienced notable growth. However, this growth has not been accompanied by development of efficient systems to ensure that the sector plays its role in an efficient manner. The government introduced Irembo a portal that ensures public service delivery however public service delivery has been plagued by lack of accountability, transparency, corruption, archaic systems, poor working conditions, and often insensitive services that lead to inefficiency, rigidity, ineffectiveness, dissatisfaction and general underperformance. In addition, the online registration of companies carried by Rwanda development Board has been having a lot of questions in terms of service delivery since even after registering a company online one has to physically take documents for verification.

Even though numerous studies have conducted locally concerning the effect of strategy implementation practices and organization performance, it is noted that little attention has been paid by previous researchers in this area thus inconclusive findings resulting to conceptual and contextual gaps. This study therefore will seek to determine the influence of strategic mission and vision practices on service delivery in public sector in Rwanda: a case of Rwanda Development Board. Hence, the need to fill these gaps.

III. LITERATURE REVIEW

Human Capital Theory

Human Capital Theory (HCP) was advanced by Theodore Shutz and Gary Becker in the early 1960’s. It state that investment in staff training increases an individual’s skills and abilities obtained can potentially increase productivity and performance of individuals ‘work. Human Capital represents the combined intelligence, skills and expertise that give the organization its distinctive character (Wolfgang, 2010). Research findings by Zahid and Khan (2011) highlights that the human elements of the organizations are those that are capable of learning, changing, innovating and providing the creative thrust which if properly motivated can ensure that long term survival of the organizations. The theory distinguishes firm-specific human capitals from general-purpose human capital. Examples of firm-specific human capital include expertise obtained through education and training in management information systems, accounting procedures, or other expertise specific to a particular firm. General-purpose human capital is knowledge gained through education and training in areas of value to a variety of firms such as generic skills in human resource development (Onyango, 2012). In practice full-time education is, too readily, taken as the principal example. For workers, investment in human capital involves both direct costs, and costs in foregone earnings (Odongo, Owuor, 2015). Despite the important role of human capital in modern societies, there are still many unknowns about the process of educational production as well as individual and collective decisions concerning how much and what kind of education to obtain.

The theory applicable in this study on the premise that employee skills and knowledge led to quality decisions formulation and implementation to promote organizational performance. Organizations should invest in employee trainings in order implement strategies formulated without difficult. Employee training will minimize change resistance and enhance strategic planning process. Hence the employees will have strategic vision and mission practices towards service delivery in Rwanda Development Board.

IV. STRATEGIC VISION AND MISSION PRACTICES

A vision statement is a company’s road map, indicating both what the company wants to become and guiding transformational initiatives by setting a defined direction for the company’s growth. Vision statements undergo minimal revisions during the life of a business, unlike operational goals which may be updated from year-to-year. Vision statements can range in length from short sentences to multiple pages. Vision statements are also formally written and referenced in company documents rather than, for example, general principles informally articulated by senior management. The creation of a broad statement about the company’s values, purpose, and future direction is the first step in the strategic-planning process. The vision statement must express the company’s core ideologies—what it stands for and why it exists—and its vision for the future, that is, what it aspires to be, achieve, or create. Commonly cited traits of a good vision include; concise, clear, future oriented, stable, challenging, abstract and inspiring. Vision statements serve as foundations for a broader strategic plan, motivate existing employees and attract potential employees, help company focus and facilitate the creation of core competencies and help companies differentiate (Darbi, & Phanuel, 2012).

V. CONCEPTUAL FRAMEWORK

A conceptual framework is a scheme of concepts or variables which the researcher operationalizes in order to achieve set objectives. It is a schematic or diagrammatic presentation of the theory. The theory is presented as a model where research variables and the relationship between them are translated into a visual picture to illustrate the interconnections between the independent and dependent variables (Oso & Onen2009). It was derived from the Human Capital theory (Wolfgang, 2010). The independent variable is strategic vision & mission practices, while the dependent variable is service delivery.

The relationship between the independent variables and the dependent variable was established by the regression model and the conceptual frame work of the study as shown in Figure 1.

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VI. RESEARCH METHODOLOGY

The study utilized the descriptive survey design. The population of this study consisted of management team, middle management level managers and low-level managers of Rwanda Development Board who in total were 114 respondents. A total of 89 employees constituted the sample size for this study. This study used stratified method to put the entire population into Six strata. These are Managers, Marketing team, Operations, Finance, Customer care and Human Resource. The researcher used both open-ended and close-ended questionnaires. These are set of questions designed to extract information relating to a survey. In this study reliability was ensured through a piloted questionnaire that was subjected to a sample of 10 staff members that were not included in the study. The 10 staff members were selected from MINECOFIN. The pre-test was conducted using Cronbach’s Alpha coefficient reliability. The researcher analyzed data using Statistical Package for Social Science (SPSS) summarize it by use of frequencies, distribution tables, and percentage. The representation of data was done by use of pie charts, bar graphs and frequency tables that helped the researcher to arrive at a descriptively meaningful analysis of the results.

VII. RESULTS AND FINDINGS

Strategic vision & mission practices

Based on research objective two, the study examined the influence of strategic vision & mission practices on service delivery in Rwanda Development Board. Respondents opinion was based on a five-point Likert scale where respondents were supposed to indicate the level of agreement with different statements regarding statements on strategic vision & mission practices. The study used a Likert scale of 1-5, where 1= No extent; 2= Little extent; 3= Some extent; 4= Great extent; 5 = Very great extent. The analysis is as shown in Table 1

Results in Table 4.10 reveal that majority of the respondent 94.2% agreed that the top management ensures quality objectives are established. 82.6% of the respondents agreed that At RDB there is Institutionalization of Corporate Vision while 89.5% of the respondents agreed that over the past year RDBs programs and projects met its goals. Lastly, 83.7% strongly agreed that vision and mission statement are used to guide RDB decisions and choice of activities.

The study agrees with Darbi and Phanuel (2012) commonly cited traits of a good vision include; concise, clear, future oriented, stable, challenging, abstract and inspiring. Vision statements serve as foundations for a broader strategic plan, motivate existing employees and attract potential employees, help company focus and facilitate the creation of core competencies and help companies differentiate.

Table 1: Descriptive analysis results for strategic vision & mission practices

<table>
<thead>
<tr>
<th>Statements</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Mean</th>
<th>Std. dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>The top management ensures quality objectives are established</td>
<td>0.0</td>
<td>3.5</td>
<td>2.3</td>
<td>61.6</td>
<td>32.6</td>
<td>4.23</td>
<td>0.66</td>
</tr>
<tr>
<td>At RDB there is Institutionalization of Corporate Vision</td>
<td>0.0</td>
<td>0.0</td>
<td>17.4</td>
<td>53.5</td>
<td>29.1</td>
<td>4.12</td>
<td>0.67</td>
</tr>
<tr>
<td>Over the past year RDBs programs and projects met its goals.</td>
<td>0.0</td>
<td>2.3</td>
<td>8.1</td>
<td>43.0</td>
<td>46.5</td>
<td>4.34</td>
<td>0.73</td>
</tr>
<tr>
<td>The vision and mission statement are used to guide RDB decisions and choice of activities.</td>
<td>0.0</td>
<td>0.0</td>
<td>16.3</td>
<td>58.1</td>
<td>25.6</td>
<td>4.09</td>
<td>0.64</td>
</tr>
</tbody>
</table>

Correlation between strategic vision and mission practices and service delivery
Correlation analysis was conducted to empirically determine whether strategic vision & mission practices had a significant effect on service delivery in Rwanda Development Board. Results indicates that strategic vision & mission practices are significantly correlated to service delivery in Rwanda Development Board (r=0.734, p= .000).

<table>
<thead>
<tr>
<th>Strategic vision &amp; mission practices</th>
<th>Service delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>.734**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
</tr>
</tbody>
</table>

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

VIII. DISCUSSION OF RESULTS

The study findings agree with Cornelissen (2014) who used a stakeholder-values perspective to explain mission: “A mission is a general expression of the overriding purpose of the organization, which, ideally, is in line with the values and expectations of major stakeholders and concerned with the scope and boundaries of the organization.

In this illustration, Organization A would prioritize cost efficiency, routinization, building upon the patents of others, and creating a reliable product with much consumer value built in. It would likely be a mid-to-late market entrant working on crops that are in steady demand. Conversely, Organization B would spend a great deal more time and resources on the laboratory science needed to alter specific crops and would be considered a market pioneer with a unique and more expensive product. Additionally, the core ethical values built into Organization A (value, reliability, output) stand in contrast with the core ethical values of Organization B (experimentation, innovation, leadership). Incentive structures in each organization would be different and employees would experience greater rewards by working in concert with organizational values (Bowen, 2015). This example illustrates how even a simple mission statement can change the overall priorities and operations of an organization.

IX. CONCLUSION

The findings of the study indicated that Strategic communication practices, Strategic vision & mission practices, Strategic organizational cultural practices and Strategic leadership practices were key driver of service delivery at Rwanda Development Board and the study concludes that employee skill development, mentorship, delegation and motivation should be embraced for enhanced service delivery.

X. RECOMMENDATIONS

The study established that Strategic leadership practices was attributed to organization service delivery even though to a larger extent some leadership practices were not embraced. Therefore, this study recommends that the Rwanda Development Board through the MIFOTRA should ensure that leaders appointed to top leadership positions are recruited on the basis of experience, knowledge and skills to drive the institutions to realize the long-term goals. Top leaders should ensure they embrace best leadership practices such as participatory leadership and accountability. The study found out that even though communication influenced service delivery, to a larger extent structures adopted discouraged two-way communication. Therefore, this study recommends that the Rwanda Development Board through the MIFOTRA should review the organization structure and adopt a more efficient and effective structures that encourage two-way communication approach for effective strategy implementation and service delivery.

XI. AREAS OF FURTHER RESEARCH

Further research could be undertaken to assess the effect of strategic planning on employee satisfaction in public sector in Rwanda.

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A Systematic Literature Review: Blockchain Based Solutions for IoT’s

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Abstract--In the modern era, Internet of things brought revolution in the everyday life activities by automation in everyday functions, modifying the approach of people to collaborate with one another or with the devices. Actually, the main feature of IoTs is direct device to device interrelationship. Their benefits range from little domestic devices to heavy industrial systems. Despite of numerous advantages of IoTs, their execution contains different issues mostly due to the severe substance of the functions by implement and because of their narrow computing abilities. Blockchain is the forthcoming annoying technology field that has achieved the attention of IoT sectors to tackle the problems by becoming encountered by themselves. In the article, the relevant issues in IoT field are pointed by us and then examined by the method how these issues can be resolved with the help of Blockchain features. Furthermore, we have also identified issues that appear while allocation of blockchain (BC) in Internet of things (IoTs).

Keywords--Internet of Things(IoT); Blockchain

1. INTRODUCTION

In modern world technologies have great impact on the life standard of humans. This revolution is for advancement in intercommunication and invention of semi-conductor materials that allow gadgets to affiliate through a network and change the path of communication among electronic devices and human beings[8]. This phenomenon is commonly termed as Internet of Things (IoT). K. Ashton was the first person who invented the term IoT in 1999. In IoT, things around us are connected to the network. These things communicate and share their information with human and also with each other by the help of sensors which are installed in it. Internet of Things (IoT) permits both communicating and non-communicating devices to communicate and to engage with each other [5]. The purpose of IoT is to establish an improved surrounding for the whole humanity which will automatically figure out the needs of people and perform accordingly[6]. From the private user’s point of view, the most apparent effect of the introduction of IoT will be seen in both working and domestic fields. IoT connects several technologies from different fields together to build its network. The summation of Internet based and context aware services along with these different technologies, provide a dynamic platform for IoT. Since the last 15 years, IoT has acquired major interest from the industry as well as educational field due to the abilities that can be proposed by IoT. IoT assures to develop the world where all the things around us will be linked to the Internet and information will be shared with one another with minimum human interference.

Internet-of-Things (IoT) is mainly a mesh of intelligent equipment including actuators, sensors and inherent chips which gather data about their equipment, ambience and convey it to global network. People and other devices use this data, to get exciting details and attain quicker solution[2]. IoT provides the main benefits of the automating the daily activities and real time supervision of equipment and functions. IoTs has ability to reform all field-of-life. As IoT has its application worldwide, complexity is increasing with the increase in IoT usage. This complexity brings IoT to vulnerability for the cyber-threats. The actual equipment in IoT is located in insecure places which might be unprotected from hackers, therefore providing themselves the chance to modify the data that move through the mesh. Thus, equipment, permissions and data root should be main issues.
[8][2]. Furthermore, IoT develops responsive personal information over their proprietors and this information is handled by central companies that bring critical issues about integrity and confidentiality of data.

In recent days, Blockchain has appeared as the innovation that has ability to manage the issues which are experienced by IoT equipment. In the Blockchain inception, it has drawn the attention of scholars from the whole world, as the advantages of Blockchain are far reaching.

In 2008 Satoshi Nakamoto first gives the concept of blockchain when he issued “Bitcoin: A P2P Electronic Cash framework”. Suggested framework was established on encrypting proof rather than precision, authorizing any two participants to perform operation without the needs of a reliable middle man[3]. Blockchain has proved a useful tool in many industries, as well as the Internet of Things. Blockchain mechanism mentioned as an open record and all performed operation are registered in a record of blocks[4]. Proof-of-stake / proof-of-work are used to create and maintain blocks. Each block includes the hash address of recent block that preserves the transactional information in network.

This information is permanent and can be watched entire duration of the mesh which finally brings to achieve the interest of human in the mesh[2]. This interest urges the human to build cash transactions, which provides a new globe of economical division in the domain of IoT. To secure the data of user, algorithms implemented in blockchain are named as public key encryption and shared concord algorithms.

The main features of blockchain technology are usually audit ability, persistency, decentralization and anonymity. The large and encouraging field of blockchain mechanism gives higher support in the academia to the learners and institutions. Considering every area of life, the blockchain mechanism is not restricted to over discussed application. The applications are raised in fields such as IoT, business, governance, medical and education etc. Furthermore, the blockchain mechanism eliminates the middle man by spreading of influence apart from the middle man in health, transmission, education, law and politics.

A systematic literature review is conducted in our paper to highlight the issues that occurs in the field of IoT and also described features of blockchain technology that will help to solve these issues. The remaining part of the article is organized as follow. In segment 2, Blockchain and its enclosed properties are examined. Segment 3 provides a summary of our review strategy & motivation behind leading this literature review. Segment 4 is distributed into three parts, Part 1 emphasizes issues in the IoT field; Part 2 analyzes how BC (Blockchain) can be utilized to solve these issues; Part 3 emphasizes issues in IoT that should be resolved. Part 4 discusses Blockchain implementation issues in IoT’s. At last, segment 5 covers the conclusion & future Work.

2. FEATURES OF BLOCKCHAIN

A. Decentralization

Decentralization can be reviewed as a security framework against hackers[2]. Blockchain is a de-centralized normal open logbook where all hubs are related with each other in a cross-linked meshwork, where all the information and decisions-making is set and split among different hubs. All parties can see every transaction on Blockchain. It permits to stay away from the congregation of power that could let an individual to take control on entire arrangement. It provides an intermediate free setup[4]. A decentralized Blockchain mechanism helps to tackle the issues of validation of the client, dependability of outsider and reliability of transactions.

B. Immutability

Digital ledger gives a temper proof atmosphere where upon every information has been saved in block, it cannot be modified or eliminated[3]. The immutability idea of Blockchain is the same as the idea of “Heihachi Mishima” in the film named “Tekken”[2]. Both ideas are set up on immortality which implies neither alterable in any manner. In that event there is some instability by exterior hubs, the hash key worth’s could be modified that these keys are encrypted connected with both preceding and previous blocks and corrections in records will trespass the constancy of keys. It implies that the Hash-function in Blockchain has capability to save the recent value or address which is self-generated by the framework over entire transaction client gives. Immutability works totally relies upon 51 percent assent having proof of work.

C. Traceability

The traceability Blockchain enables the clients to decide and follow the cause of any transaction with the assistance of a digital signature. Traceability is additional element beyond the achievement of the Blockchain. Each transaction in the blockchain associated with each other which make a chain[2]. By viewing the chain, information can be followed from inbound to outbound. E.g., a client has to distinguish where and how a nourishment thing was made. Traceability will give specific data on that precise nourishment thing producer, its creation, provided crude material information’s, shipping request spot, and goal. This suggests clients may follow the state of good as it experiences the periods of the production network[4]. This should be profitable for the client to be delighted with the manufactures and product to view at peaks and valleys in the order.

D. Trustless Network

The idea of a mediator or third party has expelled by the help of blockchain technology, when two participants want to get confirmed and a while later the transaction method will happen[24]. On Blockchain any customer can verify Proof-of-work (POW) of some different element, in this manner client validation from an outsider is not mandatory[25]. This
gives a quicker, dependable and secure method for transactions. Another backbone of Blockchain called “Self-execution” wherein the owner will compose an contract of their items and at one time it fixes any determination buyers, it will be executed though customer input. As the contacting equipment on the Blockchain mesh are quite a semi or completely computerized, a superior opinion can be built in fewer time forestalling the component of human defects.

E. Consensus mechanism
Accord system implies the regular confirmation of the considerable number of hubs identified with the blockchain network[3,26]. In this way, it doesn’t rely upon third-party. A couple of strategies for consensus mechanism are Proof-of-work (POW), Proof-of-stake (POS), and delegated proof-of-stake (DPOS).

F. Smart contract
A computerized PC program running on a blockchain share network is known as a smart contract[4]. It is a strategy of dispersal of computerized assets among minimum two participants naturally expressed by the equation decided based on information that is inspected at the period of surrounding up the contract[28]. A smart contract is a PC program that forced its accomplishments on blockchain enrolled by the accord protocol. The consensus expresses that the authentication will be completed if all hubs on network sustain the transaction.

G. Security
The influence or the association of outsider or third party is wiped out in block chain technology as this technology is totally established on P2P network[27]. The consensus mechanism is utilized for transactions and the hashes of previous block and time-stamp is contained in block that is used for the validation of transaction[4]. Transaction, synchronization of transactions with hubs on the network is ceaseless and the historical backdrop of transaction remains noticeable. This P2P and accord based nature of BCT provides the security to data of transactions.

Comparison of secondary studies
Since Blockchain innovation is slightly recent in the area of the science, so a most part of research is in progress. While finding for secondary studies, we have identified two papers that work on systematic literature review [1][2] of IoT and highlighted the main issues of IoT solved with blockchain. On other hand in our research, we have highlighted the security issues of IoT and their solution with blockchain features. Moreover, we have also highlighted some IoT security issues that are needed to be addressed.

3. SEARCH METHODOLOGY
This area includes the techniques, methodologies, and reasons to compose an SLR (systematic literature review) paper on the present issues of the IoT field and how to fathom these types of issues utilizing Blockchain mythology. Furthermore, it will offer help for scholars to figure out either the integration of IoT and Blockchain is efficient or not?

A. Motivation and Research Questions
In the present condition, IoT equipments have discovered their path in about entirely each area of human life beginning from institution, small companies and indeed they have entered in depth in the life of ordinary person. In addition to the huge interest provided by these equipment, they additionally have plenty of issues. In our article, we have pointed out some issues relevant to the IoT field and simultaneously gave the solution of these issues by using the blockchain features. In addition, we also pointed out those issues in this article, that occur after utilizing the blockchain in IoT see Table 1

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Research Question</th>
<th>Motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>What are the issues relating to IoT?</td>
<td>Goal is to highlight the security issues faced by IoT devices</td>
</tr>
<tr>
<td>2</td>
<td>Which Blockchain features are used to solve identified issues?</td>
<td>The purpose is to search out features of Blockchain that will assist in settling issues of the IoT.</td>
</tr>
<tr>
<td>3</td>
<td>What are the IoT issues that are needed to be resolved?</td>
<td>The goal is to list down those issues that are not addressed by using blockchain</td>
</tr>
<tr>
<td>4</td>
<td>What are the Blockchain deployment issues in IoT’s?</td>
<td>The goal is to figure out the issues that emerge during the deployment of Blockchain in IoT.</td>
</tr>
</tbody>
</table>

B. Search Strategy
Related to our keyword IoT and Blockchain we browsed research papers in Springer, IEEE, science direct, and ACM and figure out various results. Afterwards, we pointed out some research papers that were similar with our concern and arrange these papers in systematic form. On Google Scholar we furthermore identified various papers by forward and in reverse searching.

C. Insertion & elimination criteria
Furthermore, related to our search keyword we selected 150 unique research papers. We studied these papers. After examination of conclusion & abstract, we eliminated some research papers that were unrelated and we found around 34 research papers that were entirely similar to our concern.

D. Data abstraction
At last, a distant review of the chosen research papers, various issues are expressed through making a figure utilizing the X-mind software of every issue. Figures are also made to describe the issues that have been tackled through the Blockchain.

4. REVIEWING RESULTS

This segment shows the real findings derived from obtained review of composed research papers. We segmented it into four parts. In the 1st Part, issues in the IoT domain are pointed out as well as their concise introduction. In the 2nd part, the assessment is made on the judgment of these issues using Blockchain. Additionally, we also introduced a solution for certain issues that are examined in various relevant essential studies and are not be resolved by utilizing blockchain till now. Part 3rd emphasized issues in IoT that should be resolved. Part 4th Blockchain Implementation issues in IoT's?

A. RQ1: What are the issues regarding to the domain?

a) Single point of failure: Nowadays single point of failure is a big problem while creating IoT devices network for data storing. When a centralized network is established by connecting different IoT devices than security and availability of data is on risk[18]. In this network, all devices are connected with a centralized party and data is kept by third party at one place and it’s very easy for any hacker to access that point. After overcoming the centralized system hacker will be able to access the data[29]. This causes unauthorized data manipulation. Another thing is single point of failure which means that if centralized system stops working or crashed due to any reason the whole network will be crashed and cause a lot of issues for all devices as well as for relating users.

b) Different Computational Power of IoT Devices: The rising emission of tiny programmable built-in equipments that are simply linked with network through broadcast technologies had risen the quantity of participants eligible to take part in IoT mesh that can share data. From this point of view, the formation of tiny interconnected equipments is helpful for not just sharing of data additionally give an edge in IoT equipments sharing that can interrupt, in a bad and decent both ways, with the adjacent atmosphere[17]. If we implement this scheme to a geographic field, for example, a city or a state, we can envision a full ambit of the ground made by movable equipments that gather information and send them back to a focal bunch endpoint. The information assortment system works by joining the estimations obtained by the cell phones with the approval procedure made with particular mining software that handles the information. In this mesh mobile equipments can perform a significant role.

If this network’s data is stored at a central point, a lot of issues will occur. While creating a network board, different types of hardware are used. This board has a lot of tiny sensors deployed on it that will use a low voltage of energy. As the size will decrease, the computational power and input will be decrease, on the other hand, some of the hardwares will be greater in size automatically consume much energy[30]. Therefore tiny sensors and large hardware consumption power and also computational capability are indirectly proportion to each other. This will cause a problem in calculation of results. On the other hand, portable devices will cause an issue like in movement of any devices in different geographical area so to change the distance and connectivity mechanism of devices one by one will prove hectic for administrator.

c) Data Integrity: It is the training of being sincere and demonstrating a reliable and inflexible compliance to ethical standards and persistent moral and values in morals. Integrity is considered as the authenticity and honesty or precision of one’s actions. In a central client server model, the offender may acquire prohibited access to the mesh and change the first information or original data and forward it[7,8]. For instance, Bob sends information to Watson. Alice the center person may get information first and forward the information after alteration.

d) Data Authentication: Authentication is essential for building a link between two equipments and the swap of some private and public keys through the hub to avoid information stealing[10,11]. Any escape clause in security at the network layer or huge overhead ensure transmission may reveal the mesh to an enormous number of vulnerabilities.

e) Denial of Services: Attackers may approach to the smart home mesh and send bulk SMS to smart equipments, especially, Request to Send (RTS)/Clear to Send (CTS)[9]. They can furthermore attack to specific equipment by utilizing harsh codes so as to perform DOS attack on different equipments that are linked in a smart home. Subsequently, smart equipments can’t perform appropriate functionalities through venting resources because of such attacks. For prevention from this attack, it is essential to apply authentication to block and identify unauthorized access.

f) Trespass: In case the smart door lock is accessible by an unauthorized party or it is affected by pernicious codes, the attacker can violate on the smart home without splendid the doorway. The outcome of this impact could be a death toll or property. IoT in smart Home the IoT Smart Home facilities are increasing step by step, digital equipments can efficiently communicate with one another by using Internet Protocol (IP) addresses. In smart home Environment, each smart home equipment is attached to the internet. The possibility of malevolent attacks is increasing by the no of equipments increase in the smart home environment[9]. In Case the smart home equipments worked separately. The odds of pernicious attacks also decrease. At present smart home equipments can be on-access by using the internet at any place whenever. In this way, it raises the odds of pernicious attack on these equipments.

g) End-to-End security: Security at the end-points Internet hosts and IoT equipments are similarly significant. Using cryptographic schemas for encryption and verification codes to packets isn’t enough for asset obliged IoT. For
complete end to end security, the verification of specific personality on the both ends, protocols for actively negotiate session keys, (for example, IPsec and TLS), and algorithms (for instance Hash and AES algorithms) must be safely implemented[10]. In IoT with end to end security, the both ends can ordinarily depend on the reality that their transmission isn't apparent to any other individual, and nobody else can alter data in carriage. Proper and whole end to end security is needed, without which numerous applications would not be feasible.

h) Trusted accountability:Another attack called history revision attack, is brought up in [34]. The authors express that, for the situation, an attacker possesses a computational intensity numerous of the computational intensity of legit hubs in IoT private network for association (for example, two times higher), it is capable to generate a branch of the blockchain which could pass the current one in conditions of challenges of the POW, thus could be acknowledged by different equipments, therefore modifying the historical of the mesh[1]. At the point when scam miners will conquer the mesh and would attempt to change the past history, this will cause a major issue for the mesh.

i) Interoperability and Standardization:Equipments made by different vendors vary in services and technologies, therefore making them inconsistent[2]. As all the items would be linked through the means of Internet, consequently the task of consistency should be changed to give interoperability among the different objects and sensor hubs inside the remote sensor networks.

B. RQ2: The features of Blockchain used to settle the specified issues.

a) Single point of failure:Blockchain is a decentralized P2P network in which all the connecting hubs can share information[18]. In blockchain network all the nodes sync their storing information and compare it with one another. All the participant hubs in blockchain mesh share the same information and there is no single point for storing. In blockchain all the nodes have the capability to store same type of data, so in blockchain based network, if any irrelevant node (Hacker) wants to access the data by fake, it is much difficult task for that node. If that irrelevant node succeeds in accessing the data and wants to make some changes will be able to change the data of only one node for a short time because when data will be updated, all the nodes will sync their information with one another and in case of any vulnerability in data, they will update themselves according to the linked information and the fake user will be terminated from the network. In second scenario if any of the point get crashed, then that node will be connected to the network. This can update their whole data according to all other nodes. So in this way single point of failure in blockchain network will not disturb the whole network.

b) Different Computational Power of IoT Devices:Ethereum platform is to record assessments coming from the IoT mesh of sensors. In our frame of work, sensors are IoT equipments, customized to be associated with the blockchain and ready to send messages.

While using Ethereum platform a smart contract will be defined for all IoT devices according to need. By using smart contract these issues can be resolved[17]. In a city sense, Blockchain author has suggested a wonderful blockchain based solution to sort out this kind of issues. For example smart contract will be defined for low computational power devices according to their supporting power. On other hand smart contract will automatically handle the energy need of all devices while making this network, user will write a code in the form of Smart contract that any change occurred in system according to need, will change the whole network according to requirements. Another thing that is discussed in this issue, is movement of portable devices, smart contract will able to change the location geographically and connectivity of a particular device according to predefined description. Using smart contract methodology all the networks will be settled one time and then will update themself automatically according to required scenario.

c) Data integrity:Blockchain is a P2P uniform network wherein all hubs have a similar duplicate of record[8]. At the point when a transaction is started, the initiator hub signs the transaction with its private key and sends it to different hubs for approval. All other excavator hubs participate in repeal process and attempt to discover nonce. The hub which finds the nonce initially has the privilege to approve and get the benefit. In addition, it will communicate to every other hub of the whole network. When the record is stacked in the blockchain it can't be altered Rollback or deleted.

d) Data Authentication:Authentication’s Issues can be settled by establishing up a trustless network, that is the key element of blockchain. By scheme, information transmitted by IoT equipments associated with the blockchain network will consistently be cryptographically proved and marked by the real sender that holds GUID and a special public key, and in this manner securing integrity and authentication of transmitted information. Also, all transactions made by an IoT equipment are noted on the blockchain distributed ledger and can be monitored safely. Before sending them to different equipments the message will be digitally signed by the Sender. The recipient equipments then receive the public key from the record and use it to confirm the computerized signature of the obtained message[12][13]. We have explained the computerized signature work in the following way: 1st, the sender evaluates hash of a message that is then encoded with its private key. The computerized signature as well as the message is transferred. The recipient at that point decodes the computerized signature utilizing the public key of the sender retained in the record to get the hash value as evaluated by the sender. The message is authentic just if the evaluated hash and the protective hash of the message are similar. The trust on acquired messages are enhanced if the computerized signature of every message is saved into the ledger.

e) Denial of Services:In a blockchain network, two stages are significant to verify the network from DOS. The 1st
stage of defense can be assigned to the reality that it would be unfeasible for an attacker to instantly install malware on IoT equipments since these equipments are not directly accessed. Each transaction must be checked by the mining hubs[14].

Let us for an instant expect that the attacker in some way quiet control to infect the equipments. The second stage of defense originates from the fact that all cordial traffic must be approved by the extractors by inspecting the scheme header. The scheme header is utilized for authorizing equipments and imposing the proprietor’s control scheme over the network. Since they enquires that establish the DoS attack traffic would not be approved, they would be impeded from withdrawal of the network. The following two defense stages are especially set up and overseen by the target of a DoS attack that can be any client in the overlay.

f) Trespass: Use of Blockchain based smart home network prevents the interference of any middleware[8]. In this network all the included devices have their own storage capacity which contains similar records of all other devices also contain input transaction given by the user. When a new user will try to interfere in network give any input, the related device will verify the input transactions and previous history in blockchain. If the IoT devices find the similar history in previous data it will grant permission to the user otherwise rejected. In other scenario, if the middleware succeeds in controlling the IoT device in smart home network, meanwhile the device will match its details with other device. In case of mismatch it will be updated automatically according to the BC smart home history and hacker will be disconnected. Hence the Blockchain innovation makes the equipments competent for performing tasks without the third party or mediator, in this manner making it danger free from mediator.

g) End to End Security: The session determined b/w two VoLTE UEs are finished by 3GPP IMS standard with no progressions as explained already, which brings outcomes in the protocol. One of the solutions to produce and disperse the session keys is to utilize the Station to Station (STS) key agreement schemas. The primary benefit of this methodology is the utilization of Diffie-Hellman (DH) as a key swap (Perfect-Forward-mystery)[12,15]. The problem of public keys sharing in DH is tackled by saving them into the Blockchain. The VoLTE UE A guest customer brings the community of the VoLTE UE B called from the Ethereum and conversely. The UE A and UE B switch the DH parameters across RTP Control-Protocol (RTCP).

h) Trusted accountability: Each activity history should be transferred to the blockchain network[8,16]. This provides each activity identification and every activity is detectable. At that point, when an irregular manner is distinguished, entity send to source for extra investigation.

i) Interoperability and Standardization: A distributed arrangement of Firmware could be presented by utilizing Blockchain. Furthermore, the inflexible memory of the Blockchain, Firmware morality could be reliable and the accessibility of Firmware meanwhile proposed equipments could be guaranteed[19]. A Blockchain settled reliable Firmware update schemas is suggested to manage with Firmware issues of IoT’s. The design of this schema is included of ‘Verification’ & ‘Normal’ hubs in a Blockchain settled network. Ordinary hubs are IoT equipments which can moreover demand a Firmware relevant activity or react to different IoT equipments application. Moreover, to these hubs, there is a ‘retailer hub’ which maintains updated authentication hub with most recent data[2,20]. Once an IoT inquires a Firmware relevant update, in this (BC) Blockchain network, it acquires a feedback from different hubs to decide if it has most recent Firmware or none. On the off chance that an update is essential, at that point Verification hub gives data about the necessary update and position of its binary. On the off chance that Firmware of equipments are just latest then morality of exiting Firmware could be confirmed over the Blockchain network.

C. RQ 3: what are the security issues of IoT that are needed to be resolved?

a) Falsification: when the equipments are in the smart home, they carry out transmission with the requested host, the attacker might gather the packets by modifying the routing table in the portal. The secure-socket-layer (SSL) technique is implementing and an attacker can avoid the fake certificate. In such a way, the attacker can misconstrue the substance of information or may release the privacy of information. To protect the smart home network from this offense, the SSL technique with appropriate verification mechanism must be applied. It is too essential to block prohibited equipments that may effort to access to smart home network. The IoT is an idea that describes the prospective where the physical things associated with the internet transmission with one another and recognize themselves for different equipments[9]. The IoT framework comprises of smart things, tablets, cell phones, and the intelligent equipments etc. Such frameworks use RFID, QR (Quick Response) codes or remote technology to execute transmission between various equipments. The IoT supports to establish a connection from person to person, person to physical things, and physical things to other physical things. According to a valuation from IDC, there will be above 30 billion internet linked equipments by 2020. This speedy development of internet data demands furthermore useful and secure network.

b) Ubiquity, omnipresence: The end-user is attracted to IoT[21], gorged by it, there is no plainly out, an approach to quit up utilizing the antiquities (which will not anymore be feasible eventually, because of the producers which will provide them with Internet linked equipments.

c) Miniaturization, invisibility: PCs, as they are these days, will vanish – the equipments will be tiny and tiny, apparent, subsequently keeping away from any assessments, accounting procedures, audit and quality control[21].

d) Difficult identification: So as to be linked with the IoT, the objects are identification[31]. The accessibility to these “armies” of objects, the administration of these
identities may raise huge concern and cause difficult issues of security and control in a globalism.

e) Autonomous and unpredictable behavior: The interrelated objects may interrupt voluntarily in individual events, in surprising ways for the clients or the developer. The individuals will be a part of the IoT environments combined with equipments and artifacts, therefore making hybrid frameworks with surprising manner[21]. The gradual improvement of IoT will cause of rising manners without the clients completely understanding the environment they are vulnerable.

f) Incorporated intelligence: This produces the objects to be viewed alternative for the public activity – the objects will be dynamic and intelligent, with a rising manner; there will be enlargements (not just outside) of the human body and mind[32]. Being denied of these equipments will prompt issues – see the youngsters who regard themselves as psychologically or socially disabled without Google, social media or cell phone.

Mobile Security: Smart phones hubs in IoT repeatedly move from one bunch to another, in which encryption-based protocols are utilized to enable quick recognition, confirmation, and security refuge. A specific protocol is shown which is helpful when a smart phone hub joins another bunch. This protocol furthermore received a legitimate demands message and an answer verification message, which quickly implements authentication, privacy protection and identification. It will be valuable to defend opposing replay attacks, bugging, and location privacy attacks. Conversely with other same protocols[22], for example, essential hash protocols, it has less transmission above, progressively secure and gives more privacy protection. Condensing, additionally if the security issues of cell phones (i.e., equipments authentication and identification, key and exchange and legitimating storage) are under inquiry by scientific society, the accessible arrangements moderately address these requirements, in this way requiring additional attempts in order to enable the coordination with the other IoT technologies.

Robustness in Connectivity: In IoT, interconnect the humans and objects through sensors and guaranteeing ensured connectivity is a massive challenge[23]. Furthermore, volatile internet availability represents a significant challenge to the IoT. Henceforth, there is a squeezing need to effort on energy amassing equipments to improve the availability with the assistance of the energy mechanism.

Big Data: While big data is relevant from the IoT point of view, we have to guarantee that only appropriate information is being derived from the immense databases[33]. The Information Technology industry is looking ahead to governing the ability of big data and the IoT can highly contribute to collecting more data that would demonstrate useful to the businesses.

D. RQ 4: what are the Blockchain Implementation

Problems in internet of things?

a) Energy Consumption: Energy consumption is different in different traffic flows[14]. With the passage of time data increases, when Proof-of-Work is applied on data it takes a lot of time for searching data and also consume more energy. The miner for managing transactions is referred to energy consumption. In the smart home, miner is the most energy-consuming equipment. It performs lots of encryption and hashing and handles all other transactions. The EC (Energy Consumption) of different types of equipments is constrained to cryptography for their own transaction.

b) Scalability: A large quantity of information is produced by IoTs and it will be complicated and costly for the Blockchain to keep up and save this large amount of information. Such inability is primarily because of IoT equipments have restricted substance and there are requirements for similar stationing design where the main segment of information necessary for IoT transactions is kept by IoT equipments[1]. The 2nd Scalability issue is low output, because of the quandary of Proof-of-Work (PoW). Again for restricted ability, IoT’s, high challenge of Proof-of-work (PoW) is hard to compute. Bringing down the challenge of Proof-of-Work will make security problems[2]. Actually, this issue is the interchange between security and the scalability. These scalability problems of the Blockchain should be tended in further study as these fabricate the Blockchain badly reasonable for IoTs.

c) Anonymity: The blockchain becomes an open network and the Anonymity is imperative to protect the secret of clients[2]. Tragically, the blockchain just gives alias implies even though clients do not have actual-life identification. The client has a Public key that is utilized to execute transaction on this Open network. By Using this Public ID a client could be tracked. Furthermore, when a client utilizes various Public keys it could be tracked by linked capabilities that these numerous addresses belonging with a similar client. Solution and analysis for the Anonymity of the clients are essential to be tended to in further work.

d) Irreversible: Certainly, the blockchain has amazing properties like a shared block[4], for example, transparency, efficiency, and irreversibility. Although, there are a few drawbacks related to this characteristic of blockchain. Right now, if information is entered inaccurately, at that point it can't alter/delete, because blockchain is a P2P network have not erasable or reversible. In this way, it is a vital issue of blockchain innovation. While the present compromise frameworks permit the way toward reconciliation and voiding, envision the issues of "rollback" in the world of shackles.

e) Approval first Network Node: Initially, some organization should be first network hub and that moment there will be no available hub to ensure it, security hazard can be viewed as a feature[3]. In any case, we believe that with the enhance in numbers of hubs, such as security issues will be reduced.
5. CONCLUSION AND FUTURE WORK

We have described the systematic literature review (SLR) on Blockchain, Internet of Things and pointed out some issues relevant with an IoT field and also introduced the appropriate solutions for these issues with the help of Blockchain features. Such issues are mostly Data Integrity, Data Authentication, Denial of Services, Different computational Power of IoT Devices, Trespass and security related. Blockchain can support in maintaining security, privacy and supply of non-seller reliant Firmware be updated. Besides, inviolable history of records, Identity of equipments, Integrity of IoT information and access administrating to IoT equipments can be well controlled using the improvement of Blockchain. In addition to the advantages, we further considered some unaddressed execution issues like Anonymity, Irreversible, Scalability, Energy Consumption and Approval first Network Node of Blockchain in IoT's which give further guidance for analysts who are relevant in this field. Considering the writing, Blockchain is an engaging replacement to deal with normal issues being addressed by IoT. Maintaining the ability synergies in see the blend of the two advances is required to alter each field of life.

REFERENCES


TABLE II. ISSUES VS FEATURES

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Teacher job induction and professional development in federal Nepal

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Abstract- The ideas about this research came because of new governing system of three tiers in Nepal. It is a mega jump from unitary government to three tiers federal government system so that teachers’ job induction and professional development are challenging components to manage properly. To find the appropriate role taker and the proper execution plan is main objective of this research. McKinsey 7S management theoretical perspective was applied as a theoretical base and it was focused on staff and sharing culture. This research followed interviews and document study. Qualitative method followed in this research to cover the required data. Finally, research concluded that job induction is not followed in Nepal even it is an essential component for motivating teachers towards the profession and to keep them aware about their future results. Similarly, professional development like; training, exposure visits, workshops, observations and monitoring by supervisors and experts are tough activities to achieve the results. These activities are under the province as well as local government work better.

Index Terms- Teacher – job induction – professional development – federal Nepal – stakeholders

I. INTRODUCTION

In last century, Nepal run under Rana regime for 104 years (Sharma 1990), panchayat system under active kingship (Tamang 2000) and multiparty system under ceremonial kingship (Acharya 2006). The governing system now is federal republican system in place from the year 2015 formally. The formal education system in Nepal started during the rana regime and it continued by the following governments so that the democratization and decentralization of professional development of teachers is still less effective in place (MoEST, 2017). The central controlled unitary government showed its limited access to the teachers working in the rural and remote areas. Since teacher management was a difficult task at that time and it was not implementing job induction in a formal way as it was following by other civil service holders. Similarly, professional development of teachers was run from the central government with its regional training centers and the monitoring and execution role was appointed to the district education offices. In center, National Center for Educational Development (NCED) was established in 1993 to run the professional development activities for teachers and Department of Education was executive authority of teachers. Sometimes gaps and overlaps between these organizations reduced the effectiveness of professional development and its materialization (NCED, 2017). Government established Teacher Service Commission (TSC) in 2001 for the professional selection process of teachers.

Parajuli and Thapa have explored that there are several issues about teacher management like; teacher motivation, uneven distribution of teachers, various categories of teachers, poor implementation of training skills in the classroom, nepotism, favoritism and unnecessary influences in teacher recruitment and transfer (ADB, 2013). Similarly, Panta, Khanal, Phyak, Luitel et. al also explored job induction is an another lacking component in teacher management (MoEST, 2018). Singapore government is following V3SK model of teachers’ professional development (Soh 2014). Here, Teacher’s values, students’ values, parent’s values, skills and knowledge are equally focused about teacher quality. Teacher’s professional development in Brazil is another countable progress and focus to develop the teachers (Faubert 2009).

II. RESEARCH OBJECTIVES

- To find out the policy provision about job induction and professional development of teachers.
- To identify the key stakeholders’ experiences and perspectives about job induction and professional development of teachers.

III. RESEARCH METHODOLOGY

Research was structured in a qualitative method where document study and interviews were conducted. I followed the ideas of (Patton 1990) about the qualitative method to increase the validity and reliability of findings. Here, qualitative data covered the emotions, experiences and feelings of respondents. Interview and focus group discussion was focused on Kathmandu and Rautahat districts because these two districts represent the different community and administrative situation. I had tried to cover more stakeholders like; head teachers, teachers, committee members, parents, political figures, journalists, development partners and students also. Obviously the government officials were part of this research.

IV. DATA COLLECTION, ANALYSIS AND INTERPRETATION

Data collection was followed both primary and secondary sources that focus group and interview informants shared their...
primary ideas and the documents gave the secondary data to complete the research. Following ideas of (Hox and Boeije 2005), primary data have repetitions, confusions, jargon words and agreements disagreements at the same point. Since the data analysis required filtration first and coding for the analysis. Data analysis was the main component to be sincere to follow the right data in the right group. Also, to follow the data similar found in the document study and from the informants.

Data interpretation was sincerely observed that the original ideas of informants to be presented accordingly. Also, tracking the field data to research objective was sincere part in the research. The quantitative and qualitative data were gathered parallel and then explained for the further conclusions.

V. RESEARCH LIMITATIONS

This part of research limited on mixed method, only two components of teacher management, and purposive selection of research area and informants. All of these because of following the right area and person. The random selection may reach to the normal person who cannot answer the technical questions. The time constraint of the head teachers was another limitation that I set off time because they found very busy and distracted during the school time.

VI. ETHICAL CONSIDERATION

Research ethics were in priority and highly considered with prior consensus the informants, and institution. Also, early clarification on objectives of research so that informants have no more confusions about use and misuse of data they share. The writers and their original content as well as ideas are addressed properly cited in this research. It is tried to mention the original ideas of informant during the analysis and interpretation also.

VII. THEORETICAL STAND POINT

Both management and motivation theories are consulted in this research because an individual cannot be separated from the basic needs of Maslow that person cannot think beyond the basic needs at first. Since, employers need to address the basic needs of employees at first (McLeod, 2007). McLeod added that individuals’ journey starts with physiological needs and grows up to self-actualization after that their horizon broaden. Herbert Spencer (1820 – 1903) developed idea of "Survival of the Fittest" on the basis of Charles Darwin's theory on origin of species. It means every individual is trying his/her best to achieve the better life with facilities and recognition.

Similarly, management principles of Max Weber (1864 – 1920) were essential to follow here to address the process of management. Voet, J. V. D (2013) explained in his research about organizational change that the bureaucratic organizations are able to implement the organizational changes effectively. He added that leaders having transformational behavior are able to conduct proper supervision and then the organizations run effectively (ibid). So that this research followed the bureaucratic theoretical values and ideas of human resource management where job induction and teachers’ professional development follow the certain process for the better results. The process of job induction and professional development and the ways to address the organizational structure are based on this theory. The effectiveness of professional development events re analyzed based on the bureaucratic theory.

VIII. RESEARCH FINDINGS

Research concluded the different perspectives of service providers and the teacher stakeholders. The following points clarify it more that the importance of job induction, it’s present situation of execution and the impact of professional development of teachers.

IX. JOB INDUCTION IS AN AVOIDED COMPONENT OF TEACHER MANAGEMENT

Education Act. (1972), Teacher Service Commission (TSC, 2001) and Education Rule/Regulation (2003) are silent about job induction program for newly recruited teachers. There is defined District Education Office (DEO) as a recruitment and monitoring responsible body so that it is understood that DEO needs to conduct the job induction program. During the interview time, District Education Development and Coordination Unit (DEDCU) head explained that they are running the job induction program, it is recognized by the system and all districts are following it.

He added, “…..the teachers selected from TSC come to DEDCU office and they take part in job induction program and then they move for the recommended schools (KII)”. Initially his answer was interesting that job induction is in place even it is not defined by the policy with importance. What they do during the job induction program run by the DEDCU was another important concern in this research. He explained about time and activities during the orientation program,

“……it is about two to three hours program where selected teachers share their experiences and then DEDCU head explains about their roles, responsibilities, DO’s and DON’T in the profession (KII).”

It looks like a short orientation program for new comers and not exactly job induction because the program is not detailed on the job. Also, it is not enough for a newly recruited teacher to know the intensive information, knowledge, pros and cons of the profession. A secondary level teacher informant shared his ideas, “…..I knew from media that I am selected for secondary school math teacher. Then I did contact to the DEDCU office and they suggested that office will inform me when the MoEST sends list of success candidates and allows posting. Finally, DEDCU invited to contact in office and to receive appointment letter for the recommended school. I went there. The head of DEDCU and school supervisor spent about one hour with me and they explained about the role and responsibilities. I came back to home with my appointment letter and the next day I went to meet with head teacher of the recommended school. He said to come another
day in the school. I followed the day and went the school. He spent about 20 minutes with me and introduced with four teachers then he said to join the school from coming Sunday, the day I visited was Thursday. (KII, secondary school teacher)"

Similar way, another teacher respondent shared that civil service holders attend 45 days job induction program at the central level. They have an opportunity to understand the profession, organization and process of inclusion and handle. But teachers are not recognized and ignored by the system and authority. They are focused on how to pass the exam and then how to handle the class. There are no opportunities of learning about the profession, organization and future possibilities so that teachers are not enough encouraged and motivated.

The above sharing reflect the field reality about job induction where teachers and other civil service holders have different treatment. In gist, job induction is not in place, it is important for motivation and empowerment. It is better to address as a part of career development by the government.

X. EXECUTION PROBLEMS WITH THE HIGHLY PRIORITIZED PROFESSIONAL DEVELOPMENT OF TEACHERS

The first teacher education program (Aadhar Shikshya Talim, 1948), first National Education Planning Commission Report, (1955) and so on commission reports have put the first priority on teacher training program. Similarly, Education rule and regulation (2003) has defined on chapter 13 that there is a separate wing (National Center for Educational Development) for the professional development of teachers. Also, the development partners like; UNICEF, UNESCO, Plan international, Save the Children, and many other NGO’s are focusing on different types of training programs http://swc.org.np/ingos-detail-informations/. Beside these NGO’s, NGOs and CBOs are also running short term and not accredited training courses for the community school teachers.

The flood of training programs are limited in the same area either teaching method or use of teaching materials. These are system base training program that any authority feels some lacking and designs the training program and run out. The training program run by the NGOs are more issue base but also system drive. They collect issues during their field visit and they develop the package and they run. It shows that the training are not demand base, not need base, also not addressing the individual difficulties. Different organizations come with the different style of presentation but on the same ground of the subject matter. It is a kind of confusion for teachers that a single teacher cannot mix up the different styles and ideas and to prepare his/her own way or idea to present the students. So that teacher loss the way even they cannot develop their own way to enable the students.

A teacher respondent shared his experience,

“…..different non-government organizations organize training in different time which mostly not accredited by the government even it was collaborated with the government. The training provided by the government and non-government organizations are similar and all focused on teaching methodology. There is only difference on the way of presentation and use of materials during the training period. None of the training has addressed the issues that teachers are facing in the school or in the classroom. So, teachers enjoy the training program but they follow the same way like previous in the classroom. There are very few things implemented like; stopping corporal punishment, creating teacher – student friendly environment in the classroom, clean classroom etc (KII, teacher)”.

The above responses of informants show that teachers are receiving training but not able to implement in the classroom. It also create another issue that the limitation of professional development in teacher training on teaching learning methodology only. There are other components missing like; motivation sessions, exposure visits, individual backstopping, resourcing, result base promotions etc. One report claims that classroom are not improved, teaching learning in the classroom is not interactive and student centered and there is not much different either the teacher is trained or not (MoEST, 2018). There are only individual differences reflected in the classroom teaching learning of teachers (ibid).

Informants also shared that there are some changes after receiving the training even the student’s average achievement is not increased in a remarkable level. Classroom teaching learning is being more friendly and interactive to ensure the achievement. Also, there are other factors affecting student’s motivation and learning achievement. They added that students’ access to information technology, freedom at home, reduced control of teacher, liberal promotion are major challenges to grow students in a focused way.

XI. DISCUSSIONS AND IMPLICATIONS

Research came to following discussion and implication of the findings so that the further researchers and the academic community may benefit with the results.

Discussions

There are different experiences and perspectives about job induction in this research also. Government officials, teachers and other stakeholders have not the same reflection about it. The findings clarify that the job induction is a missing miracle even the voice are divided because the government policy documents and the teacher stakeholders are in same line that there is no provision of job induction and not in practice also.

Job induction is a missing fundamental in teaching profession

The importance of job induction is unlimited because the entire job starts from the day. Research suggested that there are two important parts of job induction where new cohort of teachers and challenges of new authority is the first part. Similarly, enabling the ideas of each teacher so that they can exercise their habits properly over the students (Stanfield and Cremin 2013). Another research suggested that there are three most important stages for newly recruited teachers where they need additional support. They added that first week of appointment is most important for receiving necessary information, first six months of recruitment for developing competences, and the three months before of the first year for stability, sustainability and certainty (Sharplin, O’Neill et al. 2011).
These evidences proof that teachers have not enough ideas in the beginning and they need more supports. In this sense, job induction can play an important role to explore their ideas, to be familiar with the professional and institutional profile, to way out new teachers roadmap for few months and finally to motivate and to encourage them. The good start up helps new teachers to perform better and to retain for long time in the schools.

Unachieved results of teacher training program

The above result findings concluded that there is not meaningful results of investment in teacher training program. Only the basic things are improved which are environmental and these are not because of training program specially. It means, the investment in training is not seen in the classroom and in the student’s achievements. Pokhrel and Behera claims that Teacher’s Professional Development (TPD) program in Nepal is not being success because of gaps between the TPD program and the teachers felt needs (Pokhrel and Behera 2016). They concluded in their report that teachers want resources, training plan in advance so that they can participate with preparation, TPD process is not set up as bottom – up, TPD sessions are more listening time rather than learning time, so that teachers want to involve in identifying new ideas during the TPD sessions and to set the plan for their schools (Pokhrel and Behera 2016).

This is an example of TPD but all other training program have similar issues that the real difficulties of teachers are not addressed.

One teacher informant added,

“….training provided by non-government organization and the government is similar. Non-government training look effective until they work in the school and they monitor. After that the classroom situation back to normal like previous. So, I am also surprised why the training is not implemented in the classroom. I think, it may require a different approach of training where teacher can play active role. (KII, teacher, Garuda municipality, Rautahat)".

Weir and Roberts conducted a research on training program and they concluded some serious issues in 30 years ago. Basically, these are influences in selection, biasness, methodological problems, and resource lacking (Weir and Roberts 1991). The research conducted in 2016 explains the similar issues with the research conducted in 1991. Since, there are some ongoing issues on teacher training program. Basically, the top – down approach of training model, methodology of training delivery and teacher resourcing are main problems.

Implications

This research helps to the government authority to apply job induction component as a key turning point in teaching profession for newly recruited teachers. Also, take ideas from research findings and to upgrade their training manuals towards more participatory and practicable. They can focus on improving classroom teaching learning and securing students’ results when they are planning the teacher training program.

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Spontaneous Splenic Haematoma Presenting as Perforated Acute Appendicitis in Young Adult

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Abstract
Background: Spontaneous splenic haematoma, in the absence of trauma is rare in young immunocompetent adult. Malignancy, infection, and medication are some of the aetiologies identified. Diagnosing spontaneous splenic haematoma is a challenge as it may mimic other disease. Case Presentation: A 21-year-old male presented to emergency district hospital with umbilical pain migrating to right iliac fossa. Physical examination revealed right iliac fossa tenderness but no peritonism. Provisional diagnosis of perforated appendicitis was made and patient was planned for open appendicectomy via Lanz incision. Reassessment revealed generalized abdominal pain and patient underwent lower midline laparotomy. Intraoperatively there was 1.8L of haemoperitoneum and haematoma was found at splenic hilum. Splenectomy was performed and patient was discharged well with prophylaxis antibiotic. Conclusion: Spontaneous splenic haematoma is rare and should be considered in young immunocompetent adult presenting with abdominal pain.

I. INTRODUCTION

Spontaneous splenic haematoma is rare and potentially life-threatening. The incidence is between 0.1% to 0.5%. A systemic review of atraumatic splenic rupture by Renzulli et al found that 845 cases was reported from 1980 to 2008¹. Most reported cases of spontaneous splenic haematoma have background history of chronic medical illness that may predispose to this condition, making it extremely rare in young, immunocompetent adult. We present a case of spontaneous splenic haematoma in young adult with no prior medical condition with atypical presentation mimicking as perforated appendicitis.

II. CASE REPORT

21-year-old male with no prior medical illness presented to emergency department with abdominal pain of one-day duration. The pain started at umbilical area and later migrated to right iliac fossa. He denied any fever, nausea or vomiting. No history of trauma was reported. Upon initial assessment, patient was not tachypnoeic or tachycardic. Initial blood pressure was 80/45 mmHg, but it rose to 109/51mmHg after fluid resuscitation. Physical examination revealed local guarding and tenderness over right iliac fossa. His haemoglobin level was normal at 11.7 g/dl, white cell count (17.1x10³/uL), urea (4.4 mmol/L) and creatinine (141 mmol/L). The rest of his blood parameters were within normal range. Electrocardiogram and chest radiography were also done and they turned out to be normal.

Provisional diagnosis of perforated appendicitis was made. Open appendicectomy via Lanz incision was arranged. However, operation was changed to lower midline laparotomy as patient developed generalized abdominal guarding and tenderness upon reassessment one hour later.

Intra-operatively 1.8 L of blood was found in the peritoneum. His appendix was normal. There was haematoma at the splenic hilum and tail of the pancreas. Abdominal packing was done and urgent contrast enhanced CT angiography was arranged. The scan revealed minimal haematoma at region of splenic hilum with no evidence of intra-abdominal active bleeder or abnormal vascular dilatation (Figure 1). Pancreas was homogenously enhanced with no peripancreatic fluid or collection. Relaparotomy, abdominal packing removal and splenectomy was performed 24 hours after first operation. Histopathology of the removed spleen showed congested spleen with haematoma.

Figure 1: Haematoma at splenic hilum with no evidence of intra-abdominal bleeder or abnormal vascular dilatation.
Post-operatively, patient’s condition remained stable. He was given post splenectomy vaccination and prophylaxis antibiotic upon discharge as per local guideline. He was discharged well on day six post operation.

III. DISCUSSION

Malignancy, infection, inflammation, drug and treatment-related are some of the aetiology identified for spontaneous splenic haematoma[1]. Hepatitis, malaria, Epstein–Barr virus infection and cytomegalovirus infection are some of the infective causes [2]. Lianos et al listed five cases of cytomegalovirus related splenic haematoma. All patients were between the age of 22 to 30-year-old with three of them has no comorbid (immunocompetent adult) [3]. Cytomegalovirus infection could be the underlying aetiology in our case too. However, we were unable to do any confirmatory test due to resource constraint.

The mechanism behind the spontaneous splenic haematoma is still not fully understood. One of the mechanisms implicated is that cellular hyperplasia and engorgement resulting in increased intrasplenic tension [3][4]. Other mechanism involves reticule endothelial hyperplasia resulting in vascular occlusion leading to thrombosis and infarction3,4.

Patient with spontaneous splenic haematoma commonly presents with non-specific upper quadrant abdominal pain. Blood investigations may reveal the underlying aetiology but it can be normal too. In our case, patient presented with migratory abdominal pain that was very typical of appendicitis, which may contribute to our decision to proceed with operation without any prior imaging.

Two modalities use for diagnosing spontaneous splenic haematoma are ultrasound and computer topography (CT). Depending on the haemodynamic status of the patient, exploratory laparotomy may be performed prior to any imaging and diagnosis is made intraoperatively [5][6]. Conservative management with blood transfusion and correction of underlying aetiology can be taken in haemodynamically stable patient [5][6].

IV. CONCLUSION

In conclusion, spontaneous splenic haematoma is rare especially in young adult with no prior medical illness. Awareness of this condition is important in order for the diagnosis to be made and managed accordingly.

APPENDIX

Appendixes, if needed, appear before the acknowledgment.

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Finding The Structure Of Speaking Task Between A Student And Native Speaker Is More Reliable Scoring Than Looking At The Results Of Writing Or Reading Tests In Pandemy

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Abstract: Being able to speak to friends, colleagues, visitors and even strangers, in a foreign language or in a language which both speakers can understand, is surely the communication goal of very many learners. Yet speaking in a foreign language is very difficult, and competence in speaking takes a long time to develop. To speak in a foreign language, learners must master the sound system of the language, have almost instant access to appropriate vocabulary and be able to put words together intelligibly with minimal hesitation. In addition, they must also understand what is being said to them, and he able to respond appropriately to maintain good-natured relations or to achieve their communicative goals. Because speaking is done in real-time, learners' abilities to plan, process and produce the foreign language are burdened greatly. For that reason, the structure of speech is quite different from that of the written language, where users have time to plan, edit and correct what they produce. In other words the research is intended to find out the organisation of ideas that is implemented in natural conversation between students and native speakers. This portrait of communication is recommended as reliable scoring in pandemic situation.

Key words: Speaking Task, Scoring, Organisation of ideas

1. Introduction
In pandemic condition, it is not easy to do a reliable scoring for students who do the online multiple-choice test for written or reading tests. This happens because it is quite often for the teacher to find their work quite the same. The students always work together and share their work with their classmates by using headphone application such as Whatsapp; as result the teacher may give excellent score to the student who is not so qualified or mark the best student with bad score. When this happens, the scoring is not fair. There are two problems which clarify the teacher in scoring. They become the problems of this research.

1. Why is Speaking test more reliable than writing or reading tests in the pandemic moment?
2. How do the students organize their ideas in their conversation becomes the paramount of reliable scoring?

2. Method
A. Research Method
This research study design uses a Research and Development method. According to Sugiyono (2010: 407), method of research and development is the research method used to produce a particular product and test the effectiveness of the product. In this research, the method of testing, speaking with native speakers, is assumed to be reliable for giving valid scoring in an online test. There are two reasons why this speaking task test is very reliable. The speaking task is done individually, and it cannot be substituted by another person.

B. Research Procedure
To get the data of speaking performance, the students are assigned to have a task of making a free dialogue with native speakers which is in the form of audio recording (mp3 format). They may use their headphones, audio recorders or their laptop to do this individual task, so the students act as if they were journalists. And the steps of Research and Development method are as follows:
It is necessary to remind the students that their voice should be dominant when the recording is on site where the background voice might be louder. The dialogue can be done via the internet application such as skype or they can do the dialogue via whatsapp. When they have recorded their task, the result is submitted for their assessment.

3. Analysing the Speaking Task

The speaking task is referred to the test that includes plans that will be given to the students and done by the teacher as the assessor. The students are asked to practice using the English language for real communication in natural setting. The setting may take a face to face dialogue or distance communication via the internet. Nunan (1993: 59) defines a communicative task as:

. . . a piece of classroom work which involves learners in comprehending, manipulating, producing or interacting in the target language while their attention is principally focused on meaning rather than form. . . . Minimally, a task will consist of some input data and one or more related activities and procedures. Input refers to the data that learners are to work on: it may be linguistic (e.g. a radio broadcast), non-linguistic (e.g. a set of photographs), or ‘hybrid’ (e.g. a road map). In addition, tasks will have, either explicitly or implicitly (and in most cases these are implicit), goals, roles of teachers and learners and a setting.

This definition is helpful for test development as well, because it details the elements that the task designer has to design: input, goals, roles and settings. Bachman and Palmer (1996: 44) have defined language use tasks in very similar terms. To modify their definition slightly for the specific context of speaking, speaking tasks can be seen as activities that involve speakers in using language for the purpose of achieving a particular goal or objective in a particular speaking situation. The emphasis in this definition is on goal-oriented language use, and it is appropriate for test tasks as well as events or ‘tasks’ outside testing situations. So the task is reliably used to test the students’ speaking performance.

Due to the pandemic condition, they are allowed to do this task by using skype or whatapp applications for making the conversation about anything they like. Besides, they can to talk in a mall, park, street, station, airport or in hotel. The results of recording are submitted as the data of reliable test for delivering their score.

The nature of the interaction, the sorts of tasks that are presented to the student, the questions asked, the topics presented, and the opportunities that are provided to show his or her ability to speak in a foreign language will show the student's performance in speaking skill. In addition to all the factors that may affect performance, the criteria used to assess the performance can vary enormously, from global assessments to detailed analytic scales. However, in this study the focus is on the way how the student create the performance of speaking task.

3. Conclusion and Recommendation

From the discussion and analysing of the speaking task done by several students, some conclusions can be described as the following:

1) In pandemic situation, written and reading test results can be shared easily among the students in classroom. Meanwhile, speaking test is more reliable than written test because the test cannot be done together with their classmates. No one complaints the scoring level that is made on the basis of speaking test. The speaking test referred to competence in pronunciation, structure, vocabulary, and understanding in communication.

2) In order to extend the dialogues, most students just move from one topic to another new topic. They do not explore the topic of the dialogues from general to specific; therefore, their competence level in general is classified as intermediate low level.

Meanwhile the recommendation can be expressed in the following:
1) Written or reading tests are good for creating various activities in pandemic situation. For valid scoring, speaking test is more reliable.

2) Teachers of English should teach their students about the way how to organize ideas that are arranged from general to specific which may be used to extend the dialogue.

5. References
Fundamental Theory for Successful A.I. Adoption in Industry

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Abstract- The world, which was just globally flat (Friedman, 2005) earlier, has suddenly turned to ether and real-time decision making by systems has become the need of the hour. This transformation is ushering in the age of global digitization. This actuation towards transformation and digitization (Kapur & Wong, 2020) has motivated businesses to look towards artificial intelligence (Huang & Rust, 2018) or A.I., as the only relevant solution. However, A.I. is still young as a technology and in-spite of all the drive and advancements that we have seen in recent times, the technology is neither matured nor standardized and unbiased. Hence, formulating the theoretical principles for successful and safe A.I. adoption, has become a quintessential reality. This paper looks to review and deliberate on the issue and drive discussions to lay down the five fundamental principles for successful A.I. adoption, which will lessen the burden of bias, owing to this new technology incubation and utilization.


I. INTRODUCTION

We are living in a world at the edge of global transformation, heralding the advent of global digitization! It is different from the prior era of digital globalization (Manyika, Lund, Bughin, Woetzel, Stamenov, & Dhingra, 2016), where matured and standardized digital platforms aided in connecting the world. Digital globalization (Manyika et al., 2016) actually began with the world as a whole, increasingly communicating information on digital platforms. It soon paved the way for the electronic boom aeron, where the consumer world interacted socially, as well as conducted business through digital and web streams. However, the initial success of the electronic boom was underplayed in its first wave, owing to lack of standardization and general consumer awareness about digital platforms, thereby misleading its assessment. This was back in 1990s, and the business to consumer world had just begun to spiral out of control, thus ending prematurely with the dotcom bubble burst (Ofek & Richardson, 2003). However, after twenty years of learning, adaptations and standardizations in terms of expectations and government policy undertakings, we have finally reached a point of absolute adoption where majority of consumers are not only well-versed, but also, prefer interacting, purchasing and surviving on pseudo-digital mode of life!

However, during the same time the business to business (b2b) world of larger corporates, enterprises and the public sector organizations had held on to the traditional methods of business administration, which relied on face to face interactions, personal touch and proof of ownership. This was primarily owing to the high value of purchases made on enterprise funds requiring assessment of underlying incumbent responsibility and following fair practice frameworks set decades ago to be followed to the letter. Hence, the business to business world, owing to a lack of cumulative interest, had only made marginal progress towards adoption of digital practices in administration, as well as purchasing through digital modes. Currently, in a world socially distanced owing to covid-19 (Mathur, 2020; Nielsen, 2020), we have seen a sudden drive towards full scale digitization, thus initializing the onset of global digitization.

A. Industry Need

In the current age of global digitization, there is an acute lack of standardized immersive digital platforms (Kaplan- Rakowski & Meseberg, 2018) that enables to engage more human senses and thereby emulate face to face connect. Today, we do have the basic framework of immersive technologies, digital platforms, intelligent systems and real-time but seamless computation on cloud (Katzan, 2008). However, covid-19 has shown that the world requires much more in terms of integrated platforms and systems (Kapur & Wong, 2020). The platforms cannot be individual systems or tools, anymore. It is required to do much more such as:

1) Capturing audience through immersive and experiential marketing,
2) Helping customers assess utility,
3) Provide user and analyst feedback,
4) Showcase value added services,
5) Capture and nurture interests expressed to potential business leads,
6) Allow customized approaches to convince the buyers and finally
7) Flow of data to standardized and matured customer relationship management or CRM systems.

Today, most of these systems are available as piece-meal solutions and there is hardly any platform which can provide all these services in a unified manner. To make matters worse, we also would need to develop overall standardization and there is also a growing concern that the individual standardizations inbuilt into these stand-alone technology systems will be inadequate (Cargill, 2011). Further, the concept of deriving return on investment for digital purchase (Cargill, 2011) is still a topic of hot debate across the business world.

However, in spite of the current predicament, we have been forced to adopt generic digital platforms to survive!

B. Hypothesis

Hence, affliction inflicted by covid-19 has provided an unprecedented impetus, resulting in paradigm shifts in the traditional way of being human. The impact has been immense in the natural way of conducting business, especially in the high value business to business purchases for the enterprise segment. The world, which was just flat earlier (Friedman, 2005), has suddenly turned into ether! Thus, there is a dire need to standardize principles of successful industry adoption, which will support development of A.I. driven digital and smart marketing & sales engine (MASE) or marketing and sales specific container systems (Hardy, 2018)!

C. Marketing & Sales Engine (MASE)

The MASE systems will provide an integrated and immersive marketing route. It will not be restricted to only easy deployment of technology, but going a mile further, it is going to usher in smart
container systems. These smart containers will eventually be able to:
1) Crawl, procure and collect information from the internet and third party databases on market conditions
2) Estimate expected demand through social listening
3) Determine marketing content to be used in campaigns
4) Optimize the content delivery mode or marketing activity, based on expected return on investment
5) Recognize the digital signals through gestures in video and text analysis of chats with audience
6) Score and route potential leads to specific sales personnel, based on experience, skill, availability and success rate and
7) Guide the sales team on likes and dislikes of a specific customer in order for sales to personalize their approach and maximize deal closure

This would be the end to end role of smart container or MASE, from generating a lead in the digital to closing a deal.

And through this extensive digitization, data explosion and requirement for decision support intelligence, artificial intelligence or A.I. (Huang & Rust, 2018) is being commonly identified by enterprise businesses as the undisputed solution to help manage data, systems, computation and finally decision making.

II. IDENTIFY, RESEARCH AND COLLECT IDEA
In this article, assessment of A.I. technology for business usage has been performed using the following methodology –

A. Secondary Research
Over the past two years, extensive research has been undertaken on the adoption criteria that every system or enterprise organization must consider to incubate and implement A.I. technology in its business functions. The focus was primarily on marketing and sales functions.

B. Primary Research and Focus Group Studies
The primary research is based on decades of professional experience of nine (9) business leaders across corporate and start-up environments. These leaders are looking for avenues to optimize cost and enable their sales and marketing teams to evolve and transform. The information was captured by conducting interviews with two or more leaders (from the sample size of nine), over three different focus group studies. Individual connections were made for primary research discussions on the importance of A.I. in a post-covid-19 era and their thoughts on the principles of adoption were taken into account.

C. Test and Control Study on Experiential Learning
Pilot studies to review adoption and absorption of any new technology, be it A.I. or machine learning technology, were conducted using test and control group technique on eighty marketing and sales personnel. These personnel were spread across asia, europe & americas. This test group of forty (40) sample size was exposed to the new CRM systems or A.I. & data science recommendation engines. Control group was composed of separate fifty (50) professionals, who were not aware of the systems or recommendations and did not receive any recommendation either. The raw data procured through voice of user feedback for the test sample size, were one hundred and sixty (160) observations and are provided in the supplement document submitted, named ‘Data’. It is a comma separated file type.

The advanced programs selected to support the test group and assess adoption were:
1) Attribute analysis (2013): Here customer or account attributes were focused on providing sales organization with a target list of customers to pursue, as these customers seemed to be a more accurate fit for a given product based on attributes studied. The study was conducted in 2013 and qualitative and quantitative observations of adoption were noted.
2) Marketing Planning customer relationship management system or CRM: New CRM system was launched to perform marketing planning with channel partners and analyze performance in real-time.
3) Predicting demand pattern from digital marketing campaign executions (2019): Here survey data from field marketing managers and performance data from digital marketing campaign executions have been analyzed. The analysis of the foundational principles or factors has been done through time series studies. The weights that arrived from the analysis were further fed as starting and reference points in recursive neural networks to set up an integrated campaign recommendation engine or RE by geography, product portfolio, periodicity, seasonality and industry vertical. The study was conducted in 2019.
4) Implementation of natural language processing (NLP) in marketing business processes (2020): Here pipeline data from CRM systems and content from campaigns were used as input to natural language processing units and long short term memory i.e. LSTM neural network was trained on the correct outputs to set up an automated engine for marketing campaign recommendation. The output could be used by anyone to get recommendations on marketing campaigns and content would generate better interest, based on and mapped to specific audience attributes. The study was conducted in 2020.

D. Variables
To deduce the fundamental principles for successful A.I. adoption, sentiment or polarity score was used as the primary variable. This helped in understanding positive or negative sentiment from voice of user feedback or bias towards technology or systems. This text feedback was primarily observed from the test and control group experiment and hence the variable sentiment was used to analyze test and control group experiment, primarily.

III. WRITE DOWN YOUR STUDIES AND FINDINGS
A. Secondary Research
From secondary research we found that A.I. as a technology is still young. To make matter worse, enterprises and organizations have not matured adequately to internalize and integrate the technology. The fundamental issue lies in the fact that the input to these systems is quintessentially biased (Silberg & Manyika, 2019), thus rendering systems we train to be eventually naïve.

Bias (Silberg & Manyika, 2019) exists in the form of –

1) Bias in data collection modalities (Silberg & Manyika, 2019): Data collection is performed using data sampling by human beings and is thereby prone to human bias. It needs to be normalized or scaled down by leveraging statistical techniques of selecting sample, while ensuring adequate sample size.

2) Bias in input data and architecture (Silberg & Manyika, 2019): Data architecture defines how unification of data from different databases, platforms and even different data entry systems occur. Gaps, auto-fills, proxies are today a common practice and create noise in data. Further, we face immense challenges in integrating data from different platforms, often resulting in incorrect setup of fields or parameters in the final database. This renders the entire data architecture erroneous and unusable.

Also this input data is what is primarily used by A.I. network to learn about the underlying patterns to analyze, making it the most crucial element for ensuring efficacy of the output. Thus, it is imperative to label and teach the A.I. system to understand the “relevance” of a > time-period, b> sensitivity of information like ethnicity or gender and location, c> imputation and proxies in data and d>identify, segregate and apply discriminatory measures to unprecedented scenarios.

Hence, a dynamic, systematic, integrated and intelligent data architecture needs to be in place for incorporating feedback and avoid bias in data architecture.

Bias are predominantly of the following form:

1) Bias in setting up correct network architecture for analysis: Selection of number of nodes, neurons and weightage for any A.I. architecture is typically driven by the developer (Silberg & Manyika, 2019). These selections are extremely important in arriving at the correct result. In practice we have often found that biased setup of these network architecture results in incremental processing time and decrease in accuracy. Thus, this bias needs to be standardized over time through human intervention and mapping for successful deployment of the technology.

2) Human bias in selection of correct algorithm for a given problem: Algorithm introduced for training the system often embeds human prejudice and hence it is prone to bias, if not peer reviewed and tested (Silberg & Manyika, 2019).

Test and Control Study on Experiential Learning

Textblob lexicon based python sentiment analysis package has been used to analyze the text feedback received. Average sentiment of all user reviews (as depicted in the python code supplementary) were positive with a polarity score of ’0.22’ (Range: -1 to +1, where lesser than or equal to 0 denotes negative/neutral sentiment & >0 denotes positives sentiment). Through adoption and absorption studies, using test and control methodology, a uniform trend was observed.

1) ~53% (Table 2) of the test group was biased against receiving recommendations, during the first week and required hand-holding and incentives to use the systems. This bias existed, in spite of positive feedback about the systems or engines from their peers, belonging to the same test group. Average sentiment of all user reviews were positive with a polarity score of ‘0.2’ (Table 1)

2) During the second week of exposure to the systems or recommendation engines, the test group provided feedback that the systems were not helping. When discussed further, it was identified that the ~63% (Table 2) of the study personnel expected more definitive result from the systems or engines. For instance, this ~63% (Table 2) of the test group, expected the customer to be welcoming the sales & marketing teams for a meet during their first call, rather than trying their sales tactics. Whenever that didn’t happen, they lost faith in the recommendation provided by the automated engine. Average sentiment of user reviews were positive with a polarity score of’0.1’ (Table 1)

3) By fifth week and further ➔ With a third and fourth week follow-up or hands-on practice on recommendations or systems respectively, whenever a success was achieved from the recommended list ➔

a. About 68% (Table 2) of the test group achieved success in generating a business lead or being able to successfully complete marketing planning. However, only some of them attributed the same to the correct recommendations or support provided by the system/ engine.

b. Rest attributed success to follow-ups performed by the individual and thereby believed that success was achieved through patience.

c. Post the study, when the observations were complied, some of the test group had generated either more leads or performed standardized marketing planning more efficiently, than those who didn’t use the support from the smart systems.

d. Average sentiment of user reviews were positive with a polarity score of’0.24’ (Table 1). Detailed sentiment or polarity score available in supplement document submitted named dfO. It is a comma separated value type.

4) One year later (with no Refresh provided) ➔ When the voice of the user feedback was reviewed to plan for the next cycle or business year, 75% (Table 2) of the test group requested for the supporting recommendations or planning systems. Further, the test group had recommended these new systems to their counterparts in the control group as well as key assets, aiding in their previous cycle performance. Average sentiment of user reviews were positive with a polarity score of’0.40’ (Table 1).
Table 1
Sentiment or Polarity Average Pivot by Week

<table>
<thead>
<tr>
<th>Week</th>
<th>Polarity or Sentiment Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>0.19</td>
</tr>
<tr>
<td>2.00</td>
<td>0.10</td>
</tr>
<tr>
<td>5.00</td>
<td>0.24</td>
</tr>
<tr>
<td>53.00</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Table 2
Respondent Sentiment % Split by Week

<table>
<thead>
<tr>
<th>Week</th>
<th>Sentiment Label</th>
<th>Respondent Count</th>
<th>% (Respondent Count per Sentiment/Week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>positive</td>
<td>19.00</td>
<td>47.50%</td>
</tr>
<tr>
<td></td>
<td>negative</td>
<td>21.00</td>
<td>52.50%</td>
</tr>
<tr>
<td>2</td>
<td>positive</td>
<td>15.00</td>
<td>37.50%</td>
</tr>
<tr>
<td></td>
<td>negative</td>
<td>25.00</td>
<td>62.50%</td>
</tr>
<tr>
<td>5</td>
<td>positive</td>
<td>27.00</td>
<td>67.50%</td>
</tr>
<tr>
<td></td>
<td>negative</td>
<td>13.00</td>
<td>32.50%</td>
</tr>
<tr>
<td>53</td>
<td>positive</td>
<td>30.00</td>
<td>75.00%</td>
</tr>
<tr>
<td></td>
<td>negative</td>
<td>10.00</td>
<td>25.00%</td>
</tr>
</tbody>
</table>

B. Focus Groups and Primary Research

Here, based on primary discussions and group studies, the following was noted –

1) 100% of the business and technology leaders (study group), participating in the study, believed that A.I. is of ubiquitous importance, as we step into a post covid-19 era.

2) 70% of the study group stated that from data management to systems making decisions in real-time, most computation will be needed to be automated and seamless through trained intelligent machines.

3) 40% of the study group believed that successful incubation and implementation of A.I. will require an absorption at the chief executive officer level. This means the chief officers of an enterprise must adapt to and adopt A.I. policies centrally and this should be transformed into a best practice. It requires to be at the root or at the core of any organization.

4) 20% of the study group elucidated that as maturity of A.I. is currently a big question, management of bias in A.I. through training and human supervision is mandatory.

5) 50% of the study group explained that like with any new technology or system, first users are always exposed to bugs, which will need to get fixed. However, it will be of absolute importance to ensure that the human users understand the technology, its limitations and design safeguards to protect against incorrect output from systems during the initial training phase.

6) 100% of the study group believed that it’s time to frame the basic rules which may enable enterprises and organizations to be A.I. ready and help them set expectations while navigating adoption process.

C. Focus Group Citations

1) COVID-19 has ushered in a new normal that has altered the complexion of business. With more than two-thirds of the buyer’s journey already digital in a pre-COVID-19 world, the acceleration to a fully digital marketing motion has never been more important. A.I. allows for closer customer engagement in a time defined by social distancing. With digital nurturing and data mining capabilities fueled by A.I., marketing organizations can help their organizations remain relevant and helpful to buyers in a fully virtual world (Allison Cerra, 2020)

2) Transformation is a cultural change (Fred Van Der Wijk & Bhooshan Parikh, 2020)

3) Humanize & make A.I. explainable (Mohan K & Nivedita Roy, 2020)

4) In the advent of the new normal previous breakthroughs in terms of digital traction have been fast forwarded to a huge extent. However in the fields of consumer insights and identifying differentiators a huge challenge has arisen in the face of overwhelming saturation in digital/social marketing. This is where a comprehensive A.I. play, both at the back end in terms of identification of opportunities and at the consumer end through identifying sharp psychographic and demographic patterns for targeted messaging can help organizations surge ahead (Anirban Tarafdar, 2020)

5) A key thing for A.I. to enrich our life and the world around us would be to understand and respond to human interactions in a way that is more human like and is not restricted to templated responses. Today A.I. has reached human parity milestones in multiple facets like object recognition, speech recognition and comprehension etc. and we have started to rely on A.I. to make decisions that we have traditionally relied on human intellect. While these are exciting times, it is really important that all these technologies are grounded in ethics. As enablers of the A.I. and associated technologies, we should take the responsibility of baking in those ethical principles from the ground up. This is no different than the good values and education that we endow in our children (Deburshi Bhowal, 2020)

6) A.I. is a transformational change and most organizations are adopting to the change. This has a far wider spectrum and most don’t realize how they can benefit from the adoption (Ayan Bagchi, 2020)

7) Systems should have free speech (Abhishek Dutta, 2020)
Table 3
Focus Group Discussion Summary

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Business Leader Name</th>
<th>Designation</th>
<th>Organization</th>
<th>What factor will drive Artificial Intelligence (AI) Adoption in B2B Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Allison Cerra</td>
<td>WW VP Geograph y Marketing</td>
<td>Hewlett Packard Enterprise</td>
<td>Digital nurturing and data mining capabilities fueled by A.I.</td>
</tr>
<tr>
<td>2</td>
<td>Nivedita Roy</td>
<td>Sr. Manager, Accenture Management Consulting</td>
<td>Accenture</td>
<td>Make A.I. driven Technology and Recommendations more explainable</td>
</tr>
<tr>
<td>3</td>
<td>Fred Van Der Wijk</td>
<td>WW Director - Channel Marketing Ops</td>
<td>Hewlett Packard Enterprise</td>
<td>A.I. needs to transform organizations from the core &amp; not from edges</td>
</tr>
<tr>
<td>4</td>
<td>K Mohan</td>
<td>WW Analytics Manager</td>
<td>Hewlett Packard Enterprise</td>
<td>Humanize A.I.</td>
</tr>
<tr>
<td>5</td>
<td>Debarshi Bhowal</td>
<td>Principal Engineer Manager</td>
<td>Microsoft</td>
<td>Make A.I. more human like</td>
</tr>
<tr>
<td>6</td>
<td>Bhooshan Parikh</td>
<td>Channel Business Manager</td>
<td>Hewlett Packard Enterprise</td>
<td>A.I. adoption will increase through a cultural change with any organization</td>
</tr>
<tr>
<td>7</td>
<td>Sharon Hiu</td>
<td>Analyst</td>
<td>Canalsy</td>
<td>A.I. will find increased adoption when it augments &amp; aids humans with technological advancement, without creating the situation where people are replaced</td>
</tr>
<tr>
<td>8</td>
<td>Anirban Tarafdar</td>
<td>Business Counselor</td>
<td>Swiggy</td>
<td>A.I. play both at backend data systems &amp; at the edge of execution will create the differentiation driving increased adoption</td>
</tr>
<tr>
<td>9</td>
<td>Ayan Bagchi</td>
<td>Chief Operating Officer</td>
<td>Reverside Software Solutions</td>
<td>Through Organizational Transformation</td>
</tr>
</tbody>
</table>

Based on the qualitative & quantitative surveys and test & control studies conducted, it can be inferred that A.I. technology though capable, is still very culpable and thereby, requires training and time to mature! As with every new technology, A.I. too will face initial resistance and lack of interest in adoption by most users in any enterprise. However, with time, exposure and training, adoption will see a steep increase.

If biases (Silberg & Manyika, 2019) in technology are not accounted for and the adoption process is not standardized (Fountaine, McCarthy, & Saleh, 2019), the output of A.I. systems may prove to be erroneous in real-time industrial applications. Furthermore, this biased (Silberg & Manyika, 2019) output will create unnecessary issues in how the business leaders will perceive benefits and adoption of this technology. It is imperative to arrest this potential of fear, uncertainty and doubt (FUD; Harsh, 2018) that may result from a rushed adoption of A.I., in business. Thus, bias (Silberg & Manyika, 2019) in A.I. must be understood and scaled before it becomes a bias against A.I. (Silberg & Manyika, 2019)

IV. CONCLUSION

Thus it is of utmost importance that we are able to derive and frame the fundamental principles of A.I. Adoption and drive standardization (Fountaine, McCarthy, & Saleh, 2019).

Through research focused studies, discussions and collective experience in attempting to adopt A.I., we deduce that the following four fundamental principles will govern successful adoption of A.I. in the near future –

1) Systems should have free speech through integration (Thórisson, 2007), interconnectivity (Ornes, 2016) and interoperability (Dutta, 2014):

One of the fundamental issues across most enterprises and organizations, especially in the pre-cloud and kubernetes era, is that most companies have their data, interactions, meta- data and platforms setup in a decentralized way. The issue was in the fundamental vision where a connected computing and storage hardware situated in a secured customer or client location, albeit cost expensive, was of primary importance and value addition. However, since the onset of digital globalization and through the initiation of clustered computing in cloud, performed by search engine, that vision slowly started changing. With the advent of global digitization, the requirement today is to pivot to systems where platforms and systems within a same function need to be unified. For A.I. to work effectively, these various platforms or
engines should be enabled to talk to each other freely through sharing of data.

Hence integration, interconnectivity and interoperability are of paramount importance.

2) A.I. needs to be a cultural change, transforming at the core (Ramakrishnan, 2019) and not from the edges (of any system):

This essentially suggests that for any system, be it an organization or even a robot, the adoption of A.I. should be a core principle at the heart of the organization, guiding all decision making.

The theory behind this principle is deduced through the test and control study. Based on observations and inference we found that in its nascent deployment phase, every new technology within any process or business requires time for adoption. During this period there are very few early adopters, owing to a myriad of reasons starting from bias and errors in the technology or system, to bias against change and learning new technology. However, with time, we see that the mind-set towards adoption and absorption changes drastically, making time invested critical for successful adoptability.

This time can only be derived if the top echelons of management and the chiefs of organizations make it a policy to drive business keeping A.I. at the core. Only then, enterprises will be able to achieve an effective adoption driving returns and benefits for any company.

3) Humanize A.I. by making it more explainable:

It essentially suggests that the human factor behind development and controllership of A.I. systems cannot be forgone.

The technology is currently biased and immature in its learning and it will require active human intervention to keep it in the correct learning curve. This underlying bias needs to be accounted for and scaled or corrected through humans governing their training. Eventually, someday A.I. maybe smart enough to stand on its own without any human intervention for it to work. Till then, we will need to ensure that A.I. systems are not misunderstood by their developers and users, but rather comprehended and nurtured by humans.

Hence, in a nutshell, true adoption can only be driven if developers humanize A.I. and make them easy to comprehend for human beings! It needs to be explainable!

4) Humanize Safeguard human beings by following the three laws of robotics (Salge, 2017):

Adoption of A.I. will mandatorily need to follow the three laws of robotics in any decision making, while arriving at the best solution for any scenario through computation of differential equations. It means that while selecting the most optimized path to solve a problem, A.I. or equivalent systems need to ensure that the solution is not prohibited by the three laws. If prohibited, A.I. computations need to iterate till it finds a proper solution, keeping the limitations in mind. The primary challenge in this is how to integrate the philosophy behind these rules in machine language while enabling an A.I. engine (Salge & Polani, 2017). However the theory of empowerment (Salge & Polani, 2017) may provide a natural solution to this issue, while ensuring the A.I. does not take steps which significantly harms its state vector(s) of the Q(s, a)), visualized and formulated during reinforcement learning (Tripathi, Ashwin, Guddeiti, 2018).

These four principles will be relevant to all systems, starting from automation of an individual process to deployment of an intelligent decision support systems in an organization.

In conclusion, integration of A.I. is becoming inevitable, but the aforementioned fundamental principles will ensure less collective failures and thereby pave the path for a true, successful and easy adoption of A.I.

REFERENCES


AUTHORS

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Correspondence Author – Abhishek Dutta, abhishek.dta@gmail.com, +91 9900017453.
Bioencapsulation Single Cell Protein from Chlorella vulgaris Extract on Survival rate and Mortality of Barramundi Larvae, Lates calcarifer, Bloch 1790

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10770

Abstract- Barramundi is one of the cultivated commodities which is being developed at this time. One of the challenges in Barramundi Aquaculture is the low survival rate due to internal mortality during the larval phase. Adequate feed supplementation, both in quantity and dose can be a solution in preventing mortality in fish larvae. The research objective was to analyze the effect of SCP on survival and mortality in barramundi larvae. This study used a plastic tub with a round shape and filled with 25 liters of water. The study was designed using a completely randomized design (CRD) method with 4 treatments and 3 replications. The treatment doses used is 0, 100, 200, and 300 mg / L. The results of the analysis of variance showed that the dose had a significant effect (P <0.05) on the survival and mortality of barramundi larvae. The results showed that using SCP at a dose of 100 mg / L increased the survival rate of 80.00% and significantly decreased the mortality rate of barramundi larvae.

Key words: Barramundi larvae, Bioencapsulation, Chlorella vulgaris, Singel cell protein, Supplementation.

I. INTRODUCTION

The main problem in the treatment of barramundi larvae (Lates calcarifer) during the production process is the low survival rate. Previous research from Nurmasyiah et.al., (2018) and Darosman et.al. (2019) obtained the results of research on survival rate barramundi larvae is still around 20-50%. The low survival rate in barramundi larvae can be caused by stress factors arising from lack of nutritional needs due to low feed quality (Basford et al., 2020), and environmental conditions that are less than optimal in larval rearing (Ribeiro et al., 2015). Inadequate nutritional requirements in live food are an important contributor to mortality in larvae during the production period. To increase the survival rate in barramundi larvae, it is necessary to improve water quality and good maintenance management as well as supplementation of live food to improve quality. Supplementation of protein and lipid forms is needed by marine fish larvae to support normal growth and improved survival (Pangkey, 2011). Supplementation that has the potential to be done is through the application of single-cell protein.

Single-cell Protein (SCP) is a biotechnology product that refers to microbial biomass or protein extract that is extracted as a food additive ((Bharti et al., 2014). In addition to protein, SCP has the potential for lipid content in the form of fatty acids reaching 35.13% (Kurnia et al., 2018). SCP has been successfully developed from several microalgae extracts such as Spirulina sp (Sharma et al., 2019). However, the use of Spirulina sp as SCP is considered inappropriate due to high production and management costs. Therefore, an alternative is needed that could potentially to replace Spirulina sp, and Chlorella vulgaris can be recommended. Research on SCP have been carried out on several species of fish and shrimp larvae, among others is tilapia fish (Hussein et al., 2013), zebra fish (Şişman et al., 2013), salmon fish (Eichner et al., 2018), and vannamei shrimp (Hamidoghli et al., 2019). However, information on the use of SCP on barramundi larvae has not been found.

The utilization of SCP in barramundi larvae is hindered by the carnivorous nature of the fish, so methods such as bioencapsulation are necessary. Bioencapsulation is nutritional enrichment using additives to natural feed to improve the quality and quantity so that the nutritional quality of natural feed can be increased (Sarmudianto et al., 2015). Based on this background, research on the benefits of Chlorella vulgaris as an SCP product needs to be done. This study aims to analyze the effect of SCP on survival and mortality in barramundi larvae.

II. METHOD

This research was conducted from June to September 2020 at the Center for brackish water fisheries development Air, Takalar regency, south Sulawesi province, Indonesia. Single-cell protein (SCP) production process at the Mini Fisheries and Water Quality Laboratory, Faculty of Marine and Fisheries Sciences, Hasanuddin University. Analysis of test samples at the Laboratory of Animal Feed Chemistry, Faculty of Animal Husbandry, Hasanuddin University.
This study used a plastic tub with a round shape, measuring 40 liters and filled with 25 liters of water for the treatment test of barramundi larvae. Treatment animals/objects used barramundi D-16 (16 days after hatched) and 50 larvae were stocked at a density of 2 Ind / L. The treatment was carried out for 10 days of maintenance. Barramundi larvae were obtained from Center for brackish water fisheries development Air, Takalar regency, south Sulawesi province, Indonesia. Bioencapsulation media using live feed with *Artemia salina*. The test material is using Single Cell Protein (SCP) from *Chlorella vulgaris* and as a solvent using seawater with 30 ppm of salinity. SCP processing requires a starter material for microalgae (*Chlorella vulgaris*) and liquid tofu waste from the waste products of the tofu factory in the Karanganyar area, Mariso District, Makassar. The nutritional content of SCP is showed in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Proximate analysis of SCP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ingredients</td>
</tr>
<tr>
<td>water</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Fat/lipid</td>
</tr>
<tr>
<td>fiber</td>
</tr>
<tr>
<td>BETN</td>
</tr>
<tr>
<td>Ash</td>
</tr>
</tbody>
</table>

The study was designed using a completely randomized design with 4 treatments and 3 replications. As treatment using different doses of SCP 0, 100, 200, and 300 mg/L. The parameters observed were the retention of nutrients absorbed in the larvae of barramundi (dissolved protein, lipids, and energy), survival, and mortality during the treatment period for barramundi larvae.

**Dissolved protein retention** is calculated using the following formula (Dewi and Tahapari, 2018):

\[ RPt = \frac{Ptb}{Kpt} \times 100 \]

Note: RPt is dissolved protein retention (%), Ptb is the increase in dissolved protein in the body (%), and Kpt is the dissolved protein content in feed (%).

**Lipid retention** is calculated using the following formula (Dewi and Tahapari, 2018):

\[ RL = \frac{Ltb}{Lp} \times 100 \]

Note: RL is the lipid retention (%), Ltb is the increase in lipids in the body (%), and Lp is the lipid content in the feed consumed (%).

**Energy retention** is calculated using the following formula (Tung and Shiau, 1991):

\[ RE = \frac{(Eend - Estart)}{FE} \times 100 \]

Note: RE is energy retention (%), Eend is final body energy (Kcal), Estart is initial body energy (Kcal), FE is total feed energy given (Kcal).

**Survival rate** is calculated using the following formula (Gunadi et al, 2016):

\[ SR = \frac{Nt}{No} \times 100 \]

Note: SR is the survival rate (%), Nt is the total number of live fish at the end of the study (tails), and No. The total number of fish at the beginning of the study (tails).

**Mortality** is calculated by comparing the total larvae at the start of the study with the total larvae that died at a certain period in the treatment period. Larval mortality data were obtained in 3 time periods, the period being the 4th day of maintenance (D-4), the 7th day of maintenance (D-7), and the 10th day of rearing (D-10). Larval mortality was calculated using the following formula (Ribeiro, 2015):
\[ \text{PM} = \frac{(N_{\text{dead}} / N_{\text{start}})}{\Delta t} \times 100 \]

Note: PM is the mortality of larvae in a certain period (%), N_{\text{dead}} is the number of dead fish larvae in a certain period (tail), N_{\text{start}} is the total number of fish at the beginning of the rearing period (tails), and \( \Delta t \) is the time interval / maintenance period (days).

During maintenance, several parameters of the water quality of the maintenance media were measured, including thermal temperature, water temperature, salinity, dissolved oxygen, pH, and ammonia. Thermal temperature was measured using a thermal thermometer, water temperature using a water thermometer, salinity using a hand refractometer, dissolved oxygen using a Digital DO meter, pH using a portable Digital pH meter and ammonia measured using a spectrophotometer. Thermal temperature and water temperature parameters were measured three times a day during the morning, afternoon and evening. Salinity, dissolved oxygen, and pH were measured daily during treatment. Ammonia parameters were measured by taking samples 3 times during treatment at the beginning, half of treatment and end of treatment.

The data obtained included dissolved protein retention, lipid retention, energy retention and survival rate for barramundi larvae, analyzed using the Analysis of Variance (ANOVA) method. Because the results have a real effect so it is continued with the W-Tuckey Test. The SPSS version 23.0 package was used as a tool for analysis. The mortality data for barramundi larvae were analyzed descriptively based on the pattern on the graph showed.

### III. RESULTS

**Retention of dissolved protein, lipid and energy content in barramundi larvae**

Retention of dissolved protein, lipid and energy content in barramundi larvae showed in table 2.

<table>
<thead>
<tr>
<th>Treatment dose (mg/L)</th>
<th>Dissolved protein retention/ RPt</th>
<th>Lipid retention/ RL</th>
<th>Energy retention/ RE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (0)</td>
<td>1.26 a</td>
<td>1.86 ± 1.85 ab</td>
<td>3.47 a</td>
</tr>
<tr>
<td>100</td>
<td>1.07 a</td>
<td>3.54 ± 0.81 a</td>
<td>7.2 a</td>
</tr>
<tr>
<td>200</td>
<td>0.3 a</td>
<td>0.85 ± 0.16 b</td>
<td>7.39 a</td>
</tr>
<tr>
<td>300</td>
<td>2.15 a</td>
<td>0.4 ± 0.33 b</td>
<td>3.44 a</td>
</tr>
</tbody>
</table>

Values of the same row with different letters were significantly different (p <0.05)

The retention of dissolved protein content showed insignificant results (P <0.05) between treatments (Table 2). The ANOVA test results showed no significant effect or effect on the treatment given. The highest percentage value was obtained at the treatment dose of 300 mg / L with a value of 2.15% while the other treatments each obtained values of 1.26%, 1.07% and 0.30% for each treatment dose control (0), 100 mg / L and 200 mg / L.

Lipid retention in the body of barramundi larvae showed significant results between treatments (P <0.05) (Table 2). The results at the treatment dose of 100 mg / L showed a significant or significant difference to the treatment at the dose of 200 mg / L and 300 mg / L, but the control treatment did not give a significant impact. The highest lipid retention value was obtained at the SCP dose of 100 mg / L with a value of 3.54%, then respectively in the control treatment, 200 mg/L, and 300 mg / L resulted in retention values of 1.86%, 0.85% and 0.4%.

Energy retention in barramundi larvae showed insignificant results (P <0.05) between treatments (Table 2). The ANOVA test results showed no significant effect or effect on the treatment given. The highest percentage value was obtained at the SCP treatment dose 200 mg / L and 100 mg / L with a value of 7.39%. and 7.20%. Then in the control dose treatment (0) and 300 mg / L, the percentage values were 3.47% and 3.44%.
Survival of barramundi larvae

Survival of barramundi larvae is showed in table 3

Table 3. Survival in Barramundi larval

<table>
<thead>
<tr>
<th>Treatment dose (mg/L)</th>
<th>Survival rate of barramundi larva (%) + STD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (0)</td>
<td>47.33 ± 9.01 b</td>
</tr>
<tr>
<td>100</td>
<td>80.00 ± 6.00 a</td>
</tr>
<tr>
<td>200</td>
<td>67.33 ± 3.05 ab</td>
</tr>
<tr>
<td>300</td>
<td>68.00 ± 12.16 ab</td>
</tr>
</tbody>
</table>

Values of the same row with different letters were significantly different (p <0.05)

The value of the survival rate of barramundi larvae showed a significant difference between treatments (P <0.05) (Table 3). The ANOVA test results show that there is a significant effect or effect on the treatment given. Treatment with a dose of SCP 100 mg / L can give a significant result or significantly different effect on control treatment (0). However, the results given did not show any significant results for other treatment doses of 200 mg / L and a dose of 300 mg / L. These results indicate that the treatment of SCP dosage as a feed supplement for barramundi larvae can give better results than treatment without SCP.

larval mortality

The development mortality of barramundi larvae is showed in Figure 1.

The development of mortality of barramundi larvae (Fig. 1) showed treatment with different doses of SCP can have an effect on mortality rates during larval rearing. The data show that the larval mortality rate has increased on the 7th day (D-7) of the maintenance period, where almost all treatments have resulted in a significant increase in mortality during that period. However, the treatment doses of 100 mg / L and 200 mg / L showed a decrease in the mortality rate during that period. The mortality of larvae at the treatment doses of 100 mg / L and 200 mg / L showed a trend or pattern that slowly decreased in each maintenance period including the D-7 period. In other treatments, the trend graph was showed to be different at the control dose (0) and the dose of 300 mg / L, where both treatments showed an increase in mortality on day 7 (D-7) of the maintenance period. This period as well as being the highest peak of mortality in that treatment during larval rearing. In the control treatment, the decrease in the mean mortality value obtained did not show a lower value than the initial maintenance period.
Environmental water quality treatment of barramundi larvae

Analysis of the quality of treatment water is shown in Table 4.

<table>
<thead>
<tr>
<th>Parameter test</th>
<th>Control (0)</th>
<th>100</th>
<th>200</th>
<th>300</th>
<th>SNI 6145.3:2014 (NSA, 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal temperature (°C)</td>
<td>28.5 - 41.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water temperature (°C)</td>
<td>27.5 - 33.5</td>
<td>2.71</td>
<td>33.1</td>
<td>27.5</td>
<td>33.1</td>
</tr>
<tr>
<td>Salinity (mg/L)</td>
<td>31-32</td>
<td>31-32</td>
<td>31-32</td>
<td>31-32</td>
<td>28-33</td>
</tr>
<tr>
<td>Dissolved oxygen (mg/L)</td>
<td>5.2 - 6.3</td>
<td>5.3</td>
<td>6.5</td>
<td>5.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Water pH</td>
<td>6.8 - 7.8</td>
<td>6.6</td>
<td>7.4</td>
<td>6.5</td>
<td>7.8</td>
</tr>
<tr>
<td>Water ammonia (mg/L)</td>
<td>0,001</td>
<td>0,002</td>
<td>0,003</td>
<td>0,003</td>
<td>max. 1</td>
</tr>
</tbody>
</table>

Based on Table 4, the water quality measurement results obtained did not show any significant differences in each treatment. The value recorded in each parameter shows the results by the standards for managing the water quality of barramundi fish larvae that have been set by National standardization agency (NSA) following SNI number 6145.3: 2014 which was published in 2014. For thermal temperature parameters in raising barramundi larvae have not been standardized by National standardization agency.

IV. RESULT

Based on the results of the study in Table 2 regarding the retention of nutrients such as dissolved protein, lipid and energy, it is indicated that the administration of SCP dosage as a bioencapsulation material for *Artemia salina* on certain parameters did not show a significant effect on treatment (P <0.05). As in the result of the dissolved protein retention value parameter, this can be influenced by the substitution value of the protein contained in SCP 8.55% or 0.085 g (Table 1). The result of this protein content is much less than the production of SCP without the compaction/drying process with a percentage value of 52.24% (Putri et al., 2018). This result is also lower than the protein hydrolyzate value in *chlorella* sp in powder form, which is 46.3 g / 100g or 0.46 g (Grossmann et al., 2018).

The results of the energy retention in Table 2 also did not show a significant effect on treatment (P <0.05). This can occur as a result of the high value of ash content in the resulting SCP, which is 76.91% (Table 1). Ash content is a collection of minerals that have properties as inorganic materials. Where this substance is not completely absorbed by the body. In the process, the main obstacle in mineral absorption is the ability of food to present enough minerals in ionized form to the apical membrane of the
enterocytes for transcellular absorption, so that not all mineral nutrients can be absorbed (Goff, 2018). As a reference, one of the studies related to bioencapsulation using a microalgae source with the type of *Spirulina* sp has a fairly low ash content value of 2.99% (Suyanto et al., 2019). The ash content produced in this study is very high.

The results of the lipid retention test in table 2 showed a significant effect on treatment (P <0.05). The value of lipid retention is thought to have a significant effect between treatments due to the effect of lipid substitution on SCP, although the resulting lipid value in this study was still low at only 0.87% (Table 1). When compared with SCP products with microalgae sources from *spirulina* sp, it can produce a lipid percentage of 7.4% (Moreira et al., 2011). However, the resulting lipid value is proven to be used properly as a nutrient in the bioencapsulated feed for barramundi larvae. Part of the lipids that are important for the body and can directly play a role in the formation of body energy are fatty acids, one of which plays an important role in the body is EPA (Suyanto et al., 2019).

Based on the survival rate data in Table 3, the survival value in the SCP dose treatment ranges from 67.33-80.00%. In terms of the results of research related to the test of the benefits of microalgae as an enrichment material in barramundi larvae, it shows the percentage of survival rate of larvae ranging from 42.75 - 55.50% (Darosman et al., 2019). Then another study showed that the average survival rate obtained in barramundi larvae obtained values ranging from 20.75 - 72.50% (Nurmasyiyah et al., 2018). Based on the results showed from previous studies, the results achieved in this study showed a much higher increase in survival rate in barramundi larvae.

Survival rate in barramundi larvae is caused by many factors. The factors that cause it can come from the adequacy of nutrients from the enrichment process of food and environmental factors that contribute to each other (Kusumawati et al., 2019). Enrichment in food/feed, especially lipid levels and energy retention levels in the body of barramundi larvae can be used as a reference in determining the effectiveness of increasing survival rate in larvae. The results of lipid retention or lipid absorption in the body of barramundi larvae that were given different doses of SCP resulted in a percentage range of 0.40% - 3.54% (Table 2). Then the lipid retention values commonly found in juvenile barramundi fish range from 0.45 to 1.59% (Phan et al., 2019). Specifically, there is no reference regarding lipid retention found in the larval phase of barramundi, but based on the reference value of retention found in the juvenile phase, in this study the lipid retention value obtained was quite high.

The important component in lipids/lipids is lipid acid, where barramundi fish larvae require intake of lipid acids such as DHA with the recommended amount of 10 g / Kg in feed (Glencross and Rutherford, 2011). However, excess nutrients in the form of lipid acids such as DHA and ARA which are given in feed substitutions where there is also one or more nutrients that do not meet the minimum nutritional needs of barramundi larvae, it can cause a decrease in survival rate in barramundi larvae (Thépot *et al.*, 2016). Therefore the dose in the substitution of feed supplements has a very important role for the larvae of barramundi. There is no more specific reference regarding the correct SCP dose in barramundi larvae, so based on the findings of this study, a treatment dose of 100 mg/L can be recommended.

Based on the data in graph 1, death during the treatment of barramundi larvae can be caused by many factors. According to Ribeiro, (2015) the factors that cause mortality in fish are due to the heterogeneity of growth so that it can cause quite high cannibalism and death from wounds and suffocation. These factors are also the causes of death found in this study. The cause of death in this study indicated a link with the nutritional substitution in larvae feed. Nutrients such as dissolved protein can be indicated to play a role in the development and life of larvae. Dissolved protein is a source of nutrition consisting of oligopeptidase bonds that are easily absorbed by the organism's body (Mardhika, et al., 2020). The Oligopeptide content has the properties or functions as antihypertensive, antimicrobial, immunomodulatory and antioxidant which is quite prominent (Jia *et al.*, 2010) As immunomodulators and antioxidants, when substituted in sufficient quantities, it can improve health performance in fish (Dwinanti and Sasanti, 2019). Therefore, it is strongly suspected that the protein substituted by administering SCP at a certain dose can supply sufficient oligopeptides into the body of the larvae.

Based on the evidence in Figure 2, it shows that in this study the mortality that contributed the most was indicated as a result of cannibalism that occurred. This is based on findings on days at the 7th rearing period (D-7) or at the age of larvae 20-22 (D-21 to D-22) days. Besides, other findings in this study also indicated that the cannibalism that occurs mostly has the same pattern as the study from Fehér *et al.*, (2013) no findings of dead fish (carcasses) where cannibalism is responsible for the death of the barramundi fish. Several studies have shown cases of cannibalism in barramundi fish are generally found to occur in the juvenile phase where the larval age ranges from 67-112 days (after hatching) (Jesu Arockiaraj and Appelbaum, 2011). Recent studies have showed cases of cannibalism begin to appear in the juvenile phase when the fish are 35 (D-35) days after hatching (Pham *et al.*, 2020). The results regarding cannibalism in susceptible larvae aged 20-22 days after hatching have not been found in several articles regarding studies that have been conducted on barramundi fish. This is new information, especially in raising barramundi larvae.

Based on the data in table 4 regarding the test results of the water quality value parameters in the rearing of barramundi fish larvae, they comply with the standards set by NSA. Recent research shows the suitability of the results of water quality parameters in raising barramundi larvae where the water quality parameter values are deformed, such as water temperature in the range of 26 - 28.5 ° C, pH values in the range of 7.5 - 8.3 and salinity levels with range 32 - 34.5 and dissolved oxygen levels> 5 (Darosman dkk., 2019). The value obtained in this study indicates the conformity of the water quality value obtained, although parameters such as water temperature in the research conducted are slightly higher. The thermal temperature has not been standardized by NSA.
However, the thermal temperature tolerance value has been tested on barramundi fish in open waters. The tolerance value is obtained at the highest value of 40 °C (Newton et al., 2010). Barramundi fish can tolerate a wide temperature range of 14–40 °C, where this species tends to be cultivated in water with a temperature range of 22 to 35 °C (Tucker, et al (2002); Thépot and Jerry, 2015). The intensive cultivation of barramundi sometimes exposes individuals to temperatures that reach above thermal tolerance temperatures. So with this reference, the value of room temperature or thermal temperature obtained in the range of 28-42 °C can be tolerated by the larvae of barramundi, although in some conditions such as during the day the temperature value showed is 2 °C higher than the tolerance value stated (Newton et al, 2013).

V. CONCLUSIONS

The conclusions in this study indicate that administering SCP doses to barramundi larvae by bioencapsulation method gives the best results at a dose of 100 mg / L. Treatment with SCP 100 mg / L can provide a survival rate of up to 80% and a decrease in mortality during treatment.

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Threats and Linkages of Regional Integration. A case of SADC Member States

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Abstract- Regional communities have proven over the years to play an important role in sustainable development and transformation worldwide. African nation states remain committed to implementing its regional integration agenda through its eight established Regional Economic Communities (RECs) within the continent. Although some significant progress has been recorded to date, the multiplicity of inter-governmental organisations and diversity of business setups in Africa and overlapping memberships in the RECs poses some threats. Notably, threat of disconnection between governments and private sector. Contrary, there is potential linkages for Regional Integration (RI) that foster implementation of regional agreements at a larger scale. It is widely acknowledged across the globe that Africa’s integration efforts have unsatisfactorily provided desirable results in comparison to other continents such as Europe and Asia. This paper explored threats and potential linkages embodied in regional integration and the nationalistic concerns from the generation ranging from the Africa founding fathers of neo-colonialism to the current 20th century states leadership ideologies focusing on the case study of Southern African Development Community (SADC). The research was a qualitative case study of the sixteen SADC member states and is informed by secondary data. The author reviewed the current twenty-six SADC protocols, website and google scholar to explore the SADC guiding processes, economic profile, demographic dividend and philosophy.

Index Terms- Regional Integration, SADC Protocols, Regional Economic Communities, SADC

I. INTRODUCTION

Regional integration suffices when a group of countries get together and develop a formal agreement. In most cases, this is by way of treaties regarding how they will conduct their regional relationships with each other. Regional integration in this study therefore denotes a phenomenon where a group of countries occupying a particular close geographical area for the safeguarding or promotion of members, and operate on terms that are fixed by treaties, or other rules and regulations. Regional integration globally is viewed as an important mechanism to boost the economic growth of most neighbouring states (Cheru, 2002). The difference of regional integration from a global perspective is originated from factors such as increased trade opportunities, desirable foreign direct investments (FDI), demographic dividend, bilateral and multilateral arrangements, improved regional relationships, and sustainable infrastructure (De Melo &Tsikata, 2014). As a result of this, (Masemola, (2005) proclaims that, from an African viewpoint, regional integration was observed as a way of redressing Africa's underdevelopment, colonial legacy, and dependence on first world nations.

Africa’s regional integration can be traced as far back as the development of the Organisation of African Unity in 1963, which saw thirty-six Africa member states coming together with the intention of achieving greater unity and peace within the region. This inter-regional organisation was leveraged on the realisation that in order to achieve any economic growth or peace on the African Continent, member states would have to work together. Continental and inter-regional cooperation and integration efforts have been ongoing for several decades now.

The Southern Africa regional economic initiative is called Southern African Development Community (SADC). Southern African Development Community (SADC) is the predecessor of the Southern African Development Coordination Conference (SADCC), established in 1980 in Lusaka, Zambia. The community now consist of a sixteen member states. These are, Angola, Botswana, Democratic Republic of Congo, Comoros, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland (eSwatini), Tanzania, Zambia and Zimbabwe.

Regional integration theory proved that such cooperation can positively contribute to capacity development, infrastructure and economic development across countries and regions (Schimmelfennig, 2018).

Broadly, the success to Africa integration has been tied to the continental economic initiatives and political decisions. The Abuja Treaty stipulated that African States must work to strengthen their regional economic communities, in particular by coordinating, harmonizing and increasingly integrating their activities in order to retain the African Economic Community (Abuja Treaty Minutes, 2000). To measure the process of integration, the Observatory on Regional Integration in Africa has identified five key pillars derived from treaties and protocols of the African Union and the Regional Economic Communities (RECs). These pillars are namely: - trade and market integration, macroeconomic policy convergence, free movement of persons, peace, security, stability and governance and harmonization of sectoral policies.

When SADCC started, its vision was mainly to become a coordination alliance and its main purpose was to coordinate development projects in order to lessen the economic hardships and dependence on the then apartheid South Africa. Since its
establishment as SADCC in 1980, SADC has gone through a number of transformations encountering challenges and opportunities mainly; the transformation processes from a Coordination Conference into a development Community (1992); expansion in areas of cooperation and integration and in its development projects; increase in membership (from nine in 1980 to the current sixteen); restructuring of institutions, that is, moving from member states coordinated programmes to a centralized structure based at the secretariat; challenges and opportunities deriving from the New Partnership for African Development (NEPAD), the Globalization Process, Poverty, and HIV and AIDS and other communicable diseases.

In 1992, as all the member states where liberated SADCC saw it important to change the name to SADC and it aligned the bloc more to a legal entity and refocused its development agenda towards economic integration. SADC became an inter government organisation with ambitions of a sound regional integration, social and economic cooperation. The new focus was inclined to driving regional integration in economic, social and security cooperation in the region. Then SADC pronounced its new mission as to ensure promotion of equitable development and sustainable growth that enhances economic, political, peace and stability in the region. The establishment of an African peace and security mechanism has become a common topic of discourse in political, security, and academic circles. The organisation of SADC is mainly in two facets that can be explained as legal entity and region which is expected to drive the economic benefits to the citizens. Basically, SADC as regional body was meant to increase the development of regional policies that are expected to strengthen socio-economic development for the region. Since inception, SADC has enacted many policies which aim at encouraging regional growth (Mapuva, J. & Muyengwa-Mapuva, L, 2014).

Within the continent, some of the other strongly related regional economic communities include the continental body called African Union (AU) and New Partnership for African Development (NePAD). Together, the three key regional and continental institutions has a strong working relationship. According to the SADC Regional Strategic Indicative Development Plan, NePAD, AU and SADC are strongly collaborative. African Union initiated NePAD, and as such is an implementation tool for the overall goals of the African Union. On the other hand, the goals and mandates of SADC are closely linked to the mandate of NePAD. Recognising these linkages, the SADC Ministers of Foreign Affairs and Finance Meeting in September 2001 concluded that SADC should be considered a part of NePAD. The rationale was suggested that, NePAD is a framework and plan of the African Union, while SADC is a recognised regional economic community of the same Union. As such, the strengthening and continued success of the implementation of projects within SADC enhances the success of the broader NePAD framework. Broadly, SADC participates in NePAD and the AU. The Ministers recognised that NePAD is a framework and process within the Union, while SADC is a recognised REC of AU. SADC participates, therefore, in both the Union and NePAD. This study examined SADC. Emphasis is on the trade and market integration which apparently is an AU pillar of regional integration. This study aims to exam the existing threats and current potential linkages embodied in this regional integration.
V. OBJECTIVES

i. To examine why SADC regional integration is not as successful in comparison to the other regional blocs such as the Asia and European Union

ii. To assess the threats and market linkages within the Southern Africa region

iii. To examine if the existing trade and market opportunities are being utilized individually or as a bloc

Conceptual Framework

The study conceptualised that threats and linkages for Regional Integration cannot be measured only by looking at geographical proximity. To measure the process of integration within SADC region, the study identified five key pillars derived from treaties and protocols of the African Union and the regional economic communities:

- Trade and Market Integration
- Macroeconomic Policy Convergence
- Free Movement of People Structural
- Harmonized Policies
- Political Governance, Peace, Security and Stability

Source: Observatory on Regional Integration in Africa

History of Regional Integration in Africa

African member states all belong to the collective security arrangement construed from the United Nations (UN) charter. On the other hand, African countries also belong to their stand-alone continental organisation called African Union (AU) formerly OAU which since the Cairo declaration of 1993 is regarded as a regional collective security arrangement guided by the chapter viii of the UN charter. A number of geographically proximate Africa states further affiliate to regional collective defence agreements – such as the treaty of Non-Aggression, Assistance and Mutual Defence: known by its French acronym – ANAD.

In Europe, although often misperceived as a regional organization, NATO is a multinational alliance for collective self-defence, as was the War-Saw Pact. A defensive alliance, according to art of the UN charter, may use force in self-defence without waiting for the Security Council (SC) to take action, (only in response to an armed attack). Contrary, Article 53 (1) of UN charter allows a regional organization to take enforcement action even if there was no prior armed attack, but with the SC authorization. Article 54 further proclaimed that, the SC shall at all times be appraised of regional agreements for the maintenance of international peace and security.

At its 37th Ordinary Session in Lusaka, in July 2001, the OAU Assembly of Heads of State and Government adopted what they called African initiative. The initiative was named the New Partnership for Africa’s Development (NePAD). NePAD sought to examine the preparedness of the Africa continent’s political and economic institutions against the forces of globalization. In other words, NePAD visualized a partnership with the North and various multilateral and multinational institutions.

AU desired to promote the tabled democratic principles to foster peace, security and stability, unity and solidarity between African countries and African peoples. The reasoning was to advance the African led political and socio-economic integration. In a way, AU acknowledged partitioning of Africa into five main sub-regions and prioritized a corresponding organization for each area. The recognised five regions are:- the Inter-Governmental Authority on Development (IGAD) in the east, the Economic Community of West African States (ECOWAS) in the West, the Arab Maghreb Union (known by its French acronym - UMA) in the North, the South Africa Development Community (SADC) in the South, and the Economic Community of Central African States (ECCAS) in the Central Africa sub-region. ECOWAS appears to be the best known of these organizations, having gained a good measure of international recognition through its massive peacekeeping efforts in Liberia and Sierra Leone. SADC region which is the impetus of this study gained a reputation for involvement in conflict resolutions activities and IGAD assumed the similar role in the resolution of sub-regional conflict. The existence of these sub-regional integration organizations, in itself, are argued as constituting threats to regional trade and economic linkages.

In many integration attempts in these African sub regions, political leaderships have resentfully protected their sovereignty and therefore not willing to compromise any of it to supranational powers. As a result, national political agents tended to detect the pace of the nature of participation in the integration initiatives. The transfer of some powers was envisioned as providing sub-regional secretariats with the necessary legitimacy. In summary, the nucleus of political will in Africa constituted an important test of commitment to an integration project. This means that strong institutions at sub-regional level would be indispensable for implementing this increasingly diverse policy and project initiatives for integration arrangements.

Lessons from ASEAN for Regional Integration in Africa

The Association of South and East Asian Nations (ASEAN) is more than 50 years old. It was formed 1967, in Bangkok, Thailand. The founding members were Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Over time, it grew to include Brunei Darussalam in 1984, Vietnam in 1995, Laos and Myanmar in 1997, and Cambodia in 1999. Today, these countries form the 10 member states of ASEAN.

In 1937, long before the region became the economic success story we admire today, Kaname Akamatsu, a Japanese scholar, developed the Flying Geese paradigm theorizing on how technological development could be promoted in Southeast Asia from Japan as a leading regional anchor. Kiyoshi Kojima, a proponent of the paradigm, argued in the 1970s that in the presence of scale economies, countries could gain from specialization even when they had similar technological levels and factor endowments. He developed a simple model in which two identical countries could produce two goods under conditions of perfect competition and identical external economies of scale. Welfare would be higher if the countries integrate and each specializes in one of the goods instead of producing both. Kojima proposed that regional agreements could help facilitate technology transfers and productivity growth following the Flying Geese paradigm. Trade integration would in turn further strengthen
cooperation as it reduces rivalry in product markets, setting in train a virtuous cycle.

Japanese theorists also conceptualized the linkages among various overseas activities of Japanese transnational corporations through subcontracting, licensing arrangement, joint ventures, and foreign direct investment with the theme of regional integration in East Asia. Their ideas helped both policymakers and the private sector map out an implementable regional integration plan. They foresaw that packaged real and financial asset flows from Japan to follower economies would augment the benefit of inter-economy linkages—both for Japan and for ASEAN countries. Foreign direct investment, which began to grow in the 1970s and dramatically accelerated after the mid-1980s, facilitated Japan’s economic restructuring—scaling down industrial sectors that were losing competitiveness and releasing resources for the sectors gaining competitiveness—while simultaneously aiding the structural transformation of many ASEAN countries.

The second thing Africa can learn from the private-sector-led regional integration in ASEAN is about the central role of family businesses. Large, diversified, family-owned businesses are indeed dominant players in ASEAN+3 (the ASEAN 10 plus China, Japan, and Korea). The family is the basic unit of management, making possible speedy decisions, and providing loyalty, flexibility, and low overheads. It also breeds trust, a crucial business element in all circumstances but especially in settings where governance is weak. Ronald Coase’s conceptualization of the nature of the firm—coincidently published in 1937—as an arrangement to reduce organizational costs is consistent with this view.

When Henry Sy, the most successful Chinese entrepreneur in the Philippines, invited his children and grandchildren for Sunday lunch, six of his company executives would show up, allowing for a discussion of plans and finances in a convivial and confidential family gathering. The Charoen Pokphand (CP) Group, Thailand’s largest conglomerate whose wealth is estimated at more than $5 billion, began as a small farm-seed company founded by a Chinese merchant who had moved to Bangkok. The company grew into a conglomerate as it expanded the market for its seed. CP now controls more than 200 companies in Thailand, Indonesia, Taiwan, Turkey, Portugal, and the Philippines. Many Western companies that later moved successfully into mainland China—such as Motorola, Coca-Cola, KFC, Lockheed, Chrysler, and Procter & Gamble—have done so by forming joint ventures with members of Chinese family conglomerates.

To be sure, such arrangements can have drawbacks. The industrial titans of the Gilded Age in the United States were largely family businesses, and the economy they built was one of the most unequal in recent times. Today, in most developed nations, the largest industry-leading companies are typically held by a broad, dispersed mix of shareholders; e.g., fewer than a third of the companies in the S&P 500 remain founder- and family-owned businesses. But as brisk growth propels emerging economies forward, a 2014 McKinsey article suggests that by 2025, family conglomerates will represent nearly 40 percent of the world’s large enterprises, up from roughly 15 percent in 2010 (Figure 1). Southeast Asia will be leading the pack; Africa will be bringing up the rear. This is something about which Africa’s leaders should think, and African economists theorize.

SADC Historical Transformation to Regional Integration

The focus of SADC from inception was on addressing the causes of colonial political liberation in Southern Africa, and reduction of dependence on the apartheid South Africa. Resolutions were passed that, the regional organisation coordinate and leverage on the strengths and resources of each other. Therefore, SADC was formed with four principal objectives, namely: reduction of member-state dependence, particularly, but not only, on apartheid South Africa; building of linkages to create sincere and unbiased regional integration; mobilisation of member-states’ resources to promote the implementation of national, interstate and regional policies; and concerted action to secure international cooperation within the framework of the strategy for economic liberation.

In 1992, Heads of Government of the region agreed to transform SADCC into the Southern African Development Community (SADC) inclining the focus to integration for regional economic development. From inception, SADC developed the desire to establish a regional integration, regional economic linkages, strengthening of the region's economic performance, and enhancement of the region's political stability.

The predominant objective of the SADC over the years has been to promote economic and social development through cooperation and economic integration. SADC transformed to attainment of regional economic integration, freedom and social justice. The transformation was anchored in the sharing of common values and principles that exist between the populations of Southern Africa. As a result, this transformation put SADC’s mission as promoting sustainable and equitable economic growth and socio-economic development; deeper co-operation and integration; as well as good governance and durable peace. Regional integration was identified as a vehicle of which this vision would be attained. The member states projected building economic linkages as the mode of harmonising the regional integration benefits. In addition to desire of economic linkages, the SADC mobilised for resources to promote the implementation of national, interstate and regional policies. The bloc further committed to collaborate to secure a stronger international bargaining power. However, the quest by the SADC regional bloc to achieve these objectives has resulted in programmes and linkages being put in place.

Since inception, regional integration has increasingly been elusive regardless the fact that SADC has presented opportunities for different countries to harmonise the member states’ different needs. SADC member states seem not pulling together towards the same goal of regional integration as evidenced by the continued existence of concurrent memberships. To date, SADC has not yet achieved its projections of liberalisation of intra-regional trade as well as establishing a common market as was targeted during its inception. Statistics show that SADC intra-regional trade is still on average 10 percent which is lower than optimum. Against a target of 85%. Against intra-regional trade of other regions such as Asia and Europe, the percentage is also comparatively lower. On average, intra-regional trade in Asia is 24 percent and in European Union 40 percent (Chidede, 2017). These statistics provide evidence that, there is still existence of different trade and market preferences contrary to the fact that SADC as a treaty envisaged equality and unity of purpose among member states.
Integration in SADC in terms of linkages realized and challenges encountered, reveals that implementation has progressed well despite the several challenges documented. SADC has been successful across a wide range of areas relating to regional cooperation and integration in comparison to other continental regional blocs. Despite the noted differences across the SADC member states, the most important achievement towards regional integration is that, appropriate policy frameworks, protocols and decisions, ratified and domesticated within the key pillars identified were put in place.

In the process of implementing the various initiatives within the SADC bloc regional integration, linkages are drawn from the challenges of domestication of agreed policies and legal frameworks, roadmaps for implementation, enforcement and follow-up mechanisms, administrative issues, capacity issues, statistics and information sharing, and budgetary constraints. This study examine the linkages and challenges posed under regional integration in SADC and sought to inform SADC member states and the wider range of relevant stakeholders on the progress made in achieving the regional integration agenda. The examination focused on the four key pillars namely: - industrial development and market Integration; infrastructure development in support of regional integration, special programmes of regional dimension; and peace and security cooperation to guide on answering the research questions.

Trade and Market Integration

At Africa continental level, there is documented efforts to scale up the intra-African trade. A number of policy frameworks were developed to stimulate the trade of goods and services through regional integration agreements designed to eliminate tariff and non-tariff barriers. Although a number of trade and market integration-related agreements, protocols and conventions have been signed among member states in their respective regional economic communities, a number of factors have contributed to its slow implementation. Among the main barriers to trade, are poor infrastructure developments, maintenance and connectivity, and conflicts and security issues in sub regions.

Moreover, a number of the continent’s railways and roads often lead to marine ports rather than cross-border linkages over land. Internal waterways are, similarly, insufficiently exploited and in most cases underdeveloped, making it difficult to conduct intra-continental business. Further emphasis to revamp national transport and infrastructure that can create linkages among African regions is therefore needed in order to improve the movement of goods and services across the continent. Regional infrastructure development programmes, such as the Programme for Infrastructure Development in Africa, are thus optimum ways to achieve continental connectivity for Africa. It is equally imperative that African countries and regional economic communities streamline and apply existing regional trade agreements into their national policy and executive bodies to obtain the benefits associated with deeper trade and market integration in Africa.

The rationale of pursuing trade and market integration within the SADC bloc is to increase intra-African trade and investments. The assumption of this researcher is, when trade relationships are existent and cost-effective, business and consumers in the regions benefit through creation of employment opportunities, foster industrial linkages, improve economic diversification and structural transformation that, by extension, generate sustainable development in the region. Intra- SADC trade remains lower than optimal. Enhancing intra-African trade, therefore, has the potential to contribute to further specialization, diversification and structural transformation within the region.

Macroeconomic Policy Convergence

Theoretically, macroeconomic policy convergence, financial and monetary integration are key variables in enhancing efficiency, promoting public accountability and economic growth. Macroeconomic policy convergence if set appropriately contributes to reductions in economic fluctuations. Harmonisation of regional macroeconomic policies contributes to economic stability within an identifies region.

Proficient macroeconomic policy convergence supports successful cross-border financial and monetary integration that stimulates trade among countries. The benefits of financial and monetary integration are dependent on the extent of trade among countries and the feasible trade creation on the continent. In the context of SADC regional integration, monetary integration is consistent to the sixth phase of the Abuja Treaty (a single currency by 2028, including an African Monetary Union and a Pan-African Parliament), initiatives of customs and monetary unions. SADC moved its motion on monetary union but to date the motive is not yet being exercised by the member states. The free movement of people across borders have been high on the regional integration agenda for member States, primarily because of the prospective trade gains that are associated with it.

Free Movement of People

Free movement of people across SADC represents a powerful instrument to economic growth and skills development when people can travel with ease for business, tourism or education. Synergic benefits accrue to member states that opens up their as seen in the growth in remittances in past years. Currently, it is not a prerequisite that member states implement the free movement of people principle.

It is fundamental to note that the free movement of people and the rights of residence and establishment constitute the fifth phase of the Abuja Treaty that is projected to be realized by 2023. Progress to date indicate that the regional businesses are not able to attain, move or retain professionals because of restrictive immigration laws that impede the mobility. Getting visas within the African continent and its sub regions has been a critical constraint to success of regional integration. Efforts were made to tackle the constraint at continental level through the African Union advocacy. The African Union advocate for the “single African passport” that aims to fulfil the above objective and improve intra-African trade as a part of Agenda 2063.

Harmonized Policies

Harmonized policies generate common understanding and team work. Common policies allow for economies of scale that lay a foundation for sustainable economic development and regional integration. It is, therefore, a core objective of the Abuja Treaty and Agenda 2063 for policies and regulations to be harmonized in all areas of the economic sphere including the sub regions such as SADC. The Abuja Treaty (1991) states that,
strengthening of sectoral integration at the regional and continental levels in all areas of activity particularly in the fields of trade, agriculture, money and finance, transport and telecommunications, industry and energy; and co-ordination and harmonisation of activities among the existing and future economic communities.

In this context, the minimum threshold for sectoral policy integration of member states in regional economic communities was supposed to have been met in 2007 to achieve the stated Africa objectives. SADC is a sub-region of AU therefore the same target applied to its member states. According to this researcher, SADC harmonized policies, regulations, procedures and monitoring mechanisms in practice are questionable despite the fact that, member states individually and collectively have a responsibility to superintend that harmonization of sectoral are implemented. The examination of the harmonized policies provided a platform to test the existing threats and linkages for SADC considering the pillar of regional integration.

Political Governance, Peace, Security and Stability

Political governance, peace, security, and stability are key tenets to achieving functional regional integration. Consideration of low Gross Domestic Products (GDP) per capita states, and unstable governance (mainly due to persistent ethnic disputes) have been stallers of regional integration progress. Historically, regional integration has been a driver for reduction of armed and non-armed conflicts and the driver of regional stability in many regions across the world. It is, however, the regional integration mechanisms that foster security within the African Union member states. These mechanisms within the regional economic communities SADC included have the obligation for promoting peace, security and stability in the continent of Africa at large. As such, SADC regional integration established formal institutional frameworks and developed peacekeeping mechanisms in their respective communities. The examination of the political governance, peace, security, and stability provided this study an opportunity to test the existing threats and linkages for SADC considering the pillar of regional integration.

VI. FINDINGS AND DISCUSSION

Why SADC regional integration is not as successful in comparison to the other regional blocs such as the Asia and European Union?

The study found the following factors as reasons why SADC regional integration is not a success story in comparison with other regional unions. The factors were identified as a combination of socio-economic and geo-political whose continued existence keep on hindering the successful consolidation of regional integration in the region.

Economic growth and development:

SADC member states are reluctant to implement policies aimed at harmonizing trade policies, labour movement, investment policies and regional (Oosthuizen, 2006). Reluctance on agreed policies aimed at increasing integration was found as an impediment factor in economic growth and development within the SADC region. Furthermore, SADC member states have not prioritized the implementation of economically friendly policies that would induce growth and development. Faye et al. (2004) however, mention that many countries in Southern Africa are confronted many internal challenges; hence many countries are focusing in fighting internal challenges rather than focusing on policies meant to consolidate regional integration further. Generally, there is a disconnection between governments and private sector.

Infrastructure challenges

Lack of enabling environment and appropriate infrastructural development initiatives in Southern Africa hinders progress towards regional trade, affects the growth potential of regional economies and ultimately the regions ability to attract foreign direct investments (Huang, 2010). Poor infrastructure characterizes the SADC region. This contributes to a low rate of industrialization and poor rates of economic growth. Subsequently, infrastructure investment becomes very difficult (Khandelwal, 2004). Ideally, the provision of free trade and the liberalization of trade policies require reliable and functional infrastructure for them to be fully entrenched and beneficial for member states.

Late ratifying of protocols:

SADC has not prioritized the realistic realignment and ratification of regional trade policies. This has created a hindrance to the aim the SADC which is to promote regional integration and growth (Crush & Dodson, 2017). The late implementation of agreed policies is attributable to mistrust or unwillingness among member states (Aall & Crocker, 2017). For example, the free labour movement policy has not been ratified despite the continuous call by the SADC member states to implement such a policy.

Poverty, Epidemics and Persistent droughts:

SADC failure to implement economic policies that promote growth has worsened the poverty and HIV problem (Tekere, 2012). The region is characterized by a high number of people living in poverty and this has affected the ability of regional member states to prioritize regionalism as they have had to divert resources in order to combat the increasing rate of poverty in the region (Zungu-Dirwayi, 2004). The ever-increasing rates of HIV infections in the region pose a significant challenge. HIV decrease the availability of skilled human capital and this will further hamper regional integration efforts. Most economies of the member states are strongly agro-based. Persistent droughts in the region affected agro-products production. Poverty, HIV and poor agriculture produce increased the rate of under development in the region and in the end increased the failure to consolidate regional integration in Southern Africa fully.

Are there threats and market linkages within the Southern Africa region?

The study found the following threats as key factors that are impeding successful regional integration efforts by member states to integrate and increase cooperation within SADC region. Generally, these threats are administrative and political in nature. The potential linkages were also identified and discussed.

Multiple and overlapping memberships
Multiple and overlapping memberships of SADC member states have been a notable threat to economic regional integration within the region. Majority of the SADC member states are also members of the COMESA. South Africa, Botswana, Lesotho and Swaziland are members of both the SACU and the SADC, while Namibia and Swaziland both hold memberships of three regional integration agreement (including the COMESA) and are part of the Common Monetary Area (which include South Africa and Lesotho) and also participate in the Regional Integration Facilitation Forum (RIFF). Overlapping membership of different RECs has not only created confusion, competition and duplication, but also constitutes a burden on the taxpayer. More so, this causes problems in the with regards to decisions to form a customs union. The customs union principle is that; no one country can simultaneously belong to two RECs at any given time.

The study also noted that, within the SADC region, there are differences in means to integration due to observed inconsistency and disjointedness in member states trade policies. Taking for example COMESA and SADC, COMESA view the benefits of integration as derived from the removal of trade and non-tariff barriers. Whereas, SADC view economic independence and political security as basis of sectoral co-operation. Another observation is, failure by member states to commit and comply with the requirements of the SADC Treaty to regional integration. This has been associated SADC failure to coordinate and harmonise trade activities within the bloc. Existence of multiple integration unions and overlapping membership and the continuing negotiations with countries outside the SADC region was found to be a threat to the agreed scope of integration in the region.

The co-existence of the SADC and other unions within the region has created further challenges for the SADC bloc focus on achieving successful regional integration objective. This study noted that, SADC member states are divided between various other continental and global institutions which pursue the same objectives. Competing other powerful economic blocs, such as, the EU contribute to the weakening of SADC union by directly negotiating with the member states instead of under the banner of SADC as a regional cooperative bloc. These forces were found as factors that threatened and derailed the SADC efforts for regional integration, especially given that the membership concur on agreed trade policies in meetings but in practice they applying different individualist interests.

**Development inequalities and diversities of economies**

SADC region is characterised by inequalities and imbalances of economies. The heterogeneity of SADC economies observed in this study has been identified as a major threat to the success of regional integration within the bloc. The diversity of these economies need serious committed member states to be integrated. There is disharmony within the regional bloc that, some member states with stronger economies than others are enjoying a comparative advantage against the weaker economies. Historically, South Africa has been the dominant economic hub of the Southern Africa region. Findings of this study reveal that, South Africa’s commitment to regional integration is questionable, mainly due to the fact that its economy has been able to attract trading partners outside of the SADC more than other SADC member states.

Hancock in his study, concurs with this argument by asserting that given that South Africa as a stand-alone state has realised more economic benefits than if it trades under both SACU and SADC membership. This suggests that its commitment to regional integration which does not offer more is compromised.

Gibb further argues that the variations in economies in the SADC has led to growing inequalities among member states. An example is the customs union theory which predicts that, member states with stronger economies receive more gains than others hence claims of inequalities. Findings of this study are in line to both Hancock and Gibb h points of view on the impact of the heterogeneity of SADC economies on regional economic integration since regional integration would be difficult to achieve in such a state of inequality among member states.

There are notable different levels of economic development with the Southern Africa regional bloc. Variations in levels of economic development, nature of resources and political state within SADC membership found in this study further threaten the functionality of the regional bloc. In this regards, the Southern Africa region body’s major economic threat has been failure to create an enabling environment for the accomplishment of viable rates of equitable economic growth which, if it was achieved, would promote regional economic integration.

This study found that, most SADC member states are still experiencing low and decreasing levels of per capita Gross National Product, low growth rates of GDP, relatively high deficient and interest rates, and relatively low savings and investments rates. The economic developments of the SADC region have since inception increasingly become uneven. This inequality in this study is identified as a threat to regional economic integration.

**Potential Linkages**

The study found that, although the heterogeneity of Southern African states is a challenge to integration, the diversity of the economies provides an opportunity for linkages among member states. The diversity provides an opportunity to assess the different types of comparative advantage within the bloc. Linkages that come with opportunities created were found to potentially promote development amongst SADC member states. In addition, this researcher argues that, African Regional Trade Agreements (RTAs) are flexible legal regimes and as such, they provide opportunities for linkages through co-operation and integrated development of common resources, the equitable distribution of gains from trade, and the principle of variable geometry. Given that each member state economy is unique the identified overlapping membership has presented an opportunity for different countries to address their different needs Linkages and cooperation are seen as vibrant vehicles of attractive investments within the Southern Africa region.

**VII. Recommendations**

The study recommends that, SADC region needs policies that are first tried and tested at the Southern Africa regional level. These policies are envisioned to promote political and economic reforms at the regional level and focus on continuing harmonization of policies and economic growth coordination. Furthermore, these policies are encouraged to take into account
the diversity and economic capacity and geo-political dimensions of regional states (Qobo, 2007). By making efforts to overcome these regional barriers, the region will not only address some of the challenges currently prevalent but also promote some economic development in its regional integration endeavours both in the short and long run. The following are other summarised recommendations:

i. The study challenge SADC to prioritize regional integration with the aim of achieving sustainable growth and development;

ii. Public-Private-Partnership commitment to implement the Regional Indicative Strategic Development Plan (RISDP);

iii. Review and streamline the management structure of all SADC institutions. Harmonisation of the management and administrative procedures and rules, varying standards, qualifications and performance criteria for staff involved in the management of the regional programme.

iv. Provide mechanism that address deemed benefits within the disparity in, and inadequate provision of resources and staffing by member states leading to inequitable distribution of responsibilities and obligations.

v. Strengthen institutional mechanism for Ministers responsible for Foreign Affairs in the SADC region to discuss and coordinate common positions on matters pertaining to the organization at various international fora.

vi. Strengthen SADC institutions in order to make them effective avenues for the attainment of deeper integration that would in the long run deliver a stable and prosperous development Community.

VIII. CONCLUSION

Broadly, regional integration is about free movement of goods across the identified region. In this case the SADC region. This means getting goods to move more easily across borders; transport, energy and telecommunications to connect more people across more boundaries; people to move more freely across frontiers, and capital and production to move and grow beyond national limits. Regional integration is a development priority for Southern Africa. Integration matters in SADC and Africa as a continent. It affects what people can buy; the variety of what is on offer at the local market; how easily citizens move between countries; where individuals travel for leisure or for work; how cost-effective it is to keep in touch; where people choose to study or look for a job; how to transfer money to family or get start-up capital for a business. Based on the findings of this study, the researcher disagrees with the hypothesis that there are no threats and linkages for regional integration within SADC bloc.

REFERENCES


[8] Initiatives at the regional economic communities include the Protocol on Finance and Investment of the Southern African Development Community (SADC), the Investment Agreement for the COMESA Common Investment Area, the East African Community Model Investment Code and the Supplementary ACT A/SA.3/12/08 Adopting Community Rules on Investment and the Modality for their Implementation with ECOWAS.


[15] Southern African Development Community Regional Indicative Strategic Development Plan


[18] www.sadc.int (accessed 15/10/20)

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Influence of addition of non-protein nitrogen to maize silage on digestibility and content of protein and sugar fractions in silage

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Abstract- In order for food to be used as soon as possible and as well as possible, it is very important that the silage that feeds the animals is prepared in such a way that it contains as much degradable protein as possible in relation to non-degradable proteins. The paper analyzes the influence of the addition of non-protein nitrogen (NPN) to the silage of the whole maize plant on the content of individual protein fractions. Of the NPN compounds, urea (at a concentration of 0.5% and 1%) and Benural S (at a concentration of 1% and 2%) were used. The amount of insoluble proteins and non-protein nitrogen in the silage increased with the addition of NPN compounds. It was quite the opposite with real proteins, the content of which was reduced by their addition. Unavailable proteins (NDICP) and cell wall-bound nitrogen (ADICP) were also most prevalent in silage without additives, and their amount decreased with the addition of NPN compounds. The highest amount of soluble proteins (SolCP) was found in silage with 1% urea (746.73 gkg⁻¹CP), and the lowest in control silage (490.2 gkg⁻¹CP). The addition of NPN compounds to maize silage resulted in a significant increase in the PA fraction of degradable proteins as well as a decrease in PB (all three subfractions) and PC fraction. The addition of non-protein nitrogen (Benural S, urea) to the corn silage of the whole plant affected the content and fractions of carbohydrates in the silage. The amount of total and non-structural carbohydrates decreased, and the amount of lignin increased with the addition of non-protein nitrogen. The addition of urea (0.5% and 1%) had the greatest effect on the amount of NDF and ADF. Differences were statistically significant (p> 0.05)

Index Terms- CNCPS, corn silage, protein fractions, carbohydrate fractions, digestibility.

I. INTRODUCTION

The number of inhabitants in the world is constantly increasing, and at the same time natural resources are decreasing, which is a great challenge for society as a whole. The constant progress of science in the field of technology for growing fodder plants, canning fodder and nutrition contributes to more efficient production of domestic animals. Regular laboratory analyzes of nutrients in as many repetitions as possible reduce the variations in the information obtained and increase the reliability of existing models, and thus give us more accurate data on the nutritional value of the tested nutrients. In this way, variations in the nutritional value of nutrients caused by sampling error, then sample handling or errors caused by the application of the analysis model itself are reduced (Hall and Mertens, 2012). Jovanović (2006) states that knowledge of the nutritional value of various nutrients used in animal nutrition is extremely important. Based on the data on the chemical composition of nutrients, it is not possible to make a correct conclusion about their nutritional value. Namely, certain nutrients are incompletely or very little used in the digestive organs of animals. Although various criteria are used to assess the nutritional value of a nutrient - digestibility is certainly the most important parameter that exactly shows the difference between the potential and true nutritional value of a nutrient.

Under the action of microbial enzymes in the rumen, a significant part of the most important nutrients - carbohydrates and proteins - is degraded, and their degradability depends on numerous factors, primarily on the chemical and physical properties of the nutrient itself (Grubić and Adamović, 2003). Yari et al., (2012) indicate that the chemical nature of the protein of certain nutrients, that is the form in which nitrogenous substances are present, is the most important factor that determines the degree and speed of decomposition in the rumen. One of the most detailed models of crude protein and carbohydrate fractionation is the “Cornell Net Carbohydrate Protein System - CNCPS” model (Fox et al., 2004).

According to this model, proteins in nutrients can be divided into three basic fractions: non-protein nitrogen (A), true proteins (B) and unavailable proteins (C). It is considered that fraction A is immediately and completely decomposed in the rumen, while fraction C is completely non-degradable in the rumen and almost completely unusable in other parts of the digestive tract (Higgs et al., 2015). Unavailable or bound proteins (fraction C) contain proteins that are associated with lignin, tannins and Millard reaction products that are highly resistant to the action of microorganisms and enzymes (Lanzas et al., 2007a). Non-protein nitrogenous substances (NPN) should be added to maize biomass during ensiling in order to increase CP content, as well as inoculants based on homo and heterofermentative bacteria in order to increase lactic and acetic acid production, and thus improve aerobic stability and nutritional value of silage (Dinić and sar., 2013). The possibility of utilizing non-protein nitrogenous substances (NPN) in ruminant diets has led to the use of synthetic NPN substances to address protein deficiencies. For this purpose,
urea or urea is most often used, which contains 42-46% N, whose content is about 2.6 times higher than in proteins. According to CNCPS (Cornell Net Protein and Carbohydrate System) system, there are five protein fractions (Sniffen et al., 1992; Fox et al., 2003).

- PA fraction of crude proteins - easily soluble proteins
- PB crude protein fraction - a potentially degradable fraction representing the difference between total crude protein and the sum of soluble and unavailable proteins: PB = CP - (NPN + ADICP)
- PC fraction of crude proteins - completely unavailable crude proteins represented by ADICP

According to the CNCPS, the PB fraction of crude protein is further divided into:
- PB1 fraction that decomposes rapidly in rumen makes it NPN non-protein nitrogen in the feed: PB1 = SoL - NPN
- PB2 fraction of medium degradability in rumen: PB2 = PB - PB1
- PB3 fraction that degrades slowly in rumen: PB3 = NPN

The aim of this research is to analyze the influence of the addition of non-protein nitrogen on the content of individual fractions of proteins and sugars in the silage of the whole corn plant. Enrichment of silage with non-protein sources of nitrogen would improve the ratio of protein and energy in silage and thus increase the nutritional value of silage in the diet of ruminants. We believe that the addition of these substances would ultimately increase the digestibility of silage.

### II. MATERIAL AND METHODS OF WORK

The experiment was performed during 2014, in Zljezine-Aleksandrovac (21010 г. О1 E, 430 26 г. 15 ) H). The plot from which corn was taken is located at an altitude of 297 m. The soil had 3.78% humus, 0.204% nitrogen, 4.9 mg P2O5 and 24.6 mg K2O per 100 mg / air dry soil. The average temperature and amount of precipitation per month in 2014 and for a period of 40 years are given in Table 1.

#### Table 1. Average temperatures and precipitation by months in 2014, and a multi-year (40-year) average for Aleksandrovac (Central Serbia)

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
<th>XI</th>
<th>XII</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp.</td>
<td>74-13</td>
<td>0.6</td>
<td>2.4</td>
<td>7.2</td>
<td>12.6</td>
<td>16.8</td>
<td>20.4</td>
<td>22.2</td>
<td>22.3</td>
<td>18.6</td>
<td>11.2</td>
<td>7.8</td>
<td>3.2</td>
</tr>
<tr>
<td>2014</td>
<td>3.5</td>
<td>6.6</td>
<td>9.4</td>
<td>11.9</td>
<td>15.9</td>
<td>19.7</td>
<td>21.7</td>
<td>21.2</td>
<td>16.8</td>
<td>11.7</td>
<td>8.4</td>
<td>2.3</td>
<td>12.4</td>
</tr>
<tr>
<td>Rain</td>
<td>74-13</td>
<td>37.7</td>
<td>63.4</td>
<td>49.4</td>
<td>44.0</td>
<td>55.9</td>
<td>90.8</td>
<td>62.0</td>
<td>34.8</td>
<td>27.8</td>
<td>71.9</td>
<td>34.4</td>
<td>72.1</td>
</tr>
<tr>
<td>2014</td>
<td>25.1</td>
<td>9.3</td>
<td>63.5</td>
<td>188.8</td>
<td>126.6</td>
<td>115.3</td>
<td>92.4</td>
<td>42.8</td>
<td>127.6</td>
<td>56.8</td>
<td>39.4</td>
<td>99.6</td>
<td>986.4</td>
</tr>
</tbody>
</table>

The biomass of maize, whole plant (hybrid KWS Mikado), was ensiled in the phase of waxy maturity of the grain with the addition of non-protein nitrogen (NPN). Urea (46% N) and Benural S (manufacturer Petrokemija-Kutina, Croatia) were used as a source of NPN, which contains 42% urea, 56% bentonite and 2% sulfur. Unlike pure urea, this product contains bentonite, which enables slower release of ammonia in the rumen and more efficient utilization by rumen microorganisms, binds some gases and toxic substances and contains important alkaline elements (K, Na, Mg, etc.). The sulfur present in Benural S enables more efficient synthesis of essential amino acids that contain this macroelement (methionine, cystine). NPN substances were added to the ensiled biomass in various concentrations. The study included 5 treatments, namely: I-without the addition of NPN substances (control), with the addition of Benural S (II-treatment with 1.0% and III-treatment with 2.0%) and with the addition of urea (IV-treatment 0 , 5% and V-treatment 1.0%). Maize was ensiled with a Mengele forage harvester (Austrian production), and 201 barrels were used for ensiling. NPN substances are added to the solid phase (urea-granules, Benural-powder). 150 kg of silo mass and the appropriate amount of NPN substances were added to each experimental vessel, and compaction was performed by trampling.
The silo mass is covered with nylon and pressed with 15-20 cm of gravel. All treatments were done in 3 repetitions, after the maturation of the silage, samples were taken for chemical analysis. Protein fractions in ensiled biomass, which were analyzed in these studies, were determined according to the method given in their studies by Licitra et al. (1996):
- The amount of total proteins was calculated indirectly, over the amount of total nitrogen determined by the Kjeldahl method on the TECATOR Kjeltc Auto Analyzer 1030 (AOAC, 984.13).
- True Proteins - TP (True Protein) were determined by protein precipitation with the addition of trichloroacetic acid, from which the amount of nitrogen was determined according to Kjeldahl and multiplied by a factor of 6.25.
- Non-Protein Nitrogen - NPN (Non Protein Nitrogen) was calculated as the difference between the total amount of protein and real protein.
- Insoluble Proteins - IP (Insoluble Protein) was determined as the amount of protein in the residue that does not dissolve in a buffer solution whose pH value corresponds to the pH in the rumen, multiplied by a factor of 6.25.
- Nitrogen bound to the cell wall - NDICP (Neutral Detergent Insoluble Crude Protein) was determined as the amount of nitrogen in the rest of the sample insoluble in a solution of neutral detergent, multiplied by a factor of 6.25.
- Unavailable Proteins - ADICP (Acid Detergent Insoluble Crude Protein) was determined as the nitrogen in the rest of the sample that is insoluble in the acid detergent solution, multiplied by a factor of 6.25.
- Soluble Proteins - SoIP (Soluble Protein) was calculated as the difference between total and insoluble proteins.
- NDF (Neutral Detergent Fiber) - fibers insoluble in a solution of neutral detergent was determined without the use of Na2SO3 according to the method given in their studies, were determined
- ADF (Acid Detergent Fiber) - was determined as the food fraction insoluble in the acid detergent solution, and the amount of lignin by treating this insoluble residue with 72% H2SO4 solution for 3 h (AOAC, 973.18).

Total carbohydrates (CHO) and non-fibrous carbohydrates (NFCs) were calculated according to equations NRC (2001):
CHO = 1000 - (CP + SmA + SPe)  
NFC = 1000 - [(NDF - NDICP) + CP + SmA + SPe]  
- the amount of lignin (ADL) was determined as a residue insoluble in 72% sulfuric acid (Van Soest and Robertson, 1980).
- In vitro digestibility of dry matter was determined by measuring the residue after successive hydrolysis using the enzymes pepsin and cellulase (De Boever et al., 1986). The obtained data related to the share of individual protein and sugar fractions in the silage were processed by the method of analysis of variance according to a completely random plan. The data program STATISTICA - 7.1 was used for data processing (StatSoft, 2006). Differences between mean treatment values were tested by LSD test at a significance level of 95%.

III. RESULTS AND DISCUSSION

The amount of dry matter had an average value of 340.7 gkg-1, the highest dry matter was treated with 1% Benural, and the least treated with the addition of urea. The results obtained in this way can also be interpreted in the way of work, because urea was previously dissolved in water and then added, which could have had an effect on the increased humidity of silage with urea. Slightly lower results in terms of dry matter content (313.4 - 325.6 gkg-1) were established by Jovanović (2006) The addition of non-protein compounds (Benural, urea) to the corn silage of the whole plant affected the amount and fractions of proteins in the silage. The concentration of crude protein (CP) in silages increases with the addition of NPN compounds, going from control silage to silages with the highest dose of nitrogen compounds. The crude protein content ranged from 77.58 gkg-1DM in control silage to 158.5 gkg-1DM in silage with 1% urea, which is expected because urea has the highest concentration of nitrogen in it. The obtained results are significantly higher than the results of Stojanović and Grubić (2008) who state the value of 42.86 gkg-1DM and Dinić et al., (2013) in silages without additives and with the addition of inoculants (61.3-63.2 gkg-1DM). Fox et al., (2003) report crude protein content over 90 gkg-1DM. This value is higher than our control treatment, but is lower than the other four treatments in which non-protein compounds were added. The addition of Benural, in the amount of 1% of the biomass of the whole corn plant, provides an increase in crude protein close to 50% (Dinić et al., 2013). The amount of crude protein in corn silage largely depends on the climate and the amount of nitrogen fertilizers applied. Most whole-plant corn silages originating from the northern parts of Serbia have a higher crude protein content. Statistical significance was found between all 5 silage treatments.

The amount of true protein (TP) averaged 387.74 gkg-1CP, was highest in the control silage (558.8 g / kg-1CP) and decreased with the addition of NPN compounds. The least true protein was found in silage with 1% urea (262.13 g / kg-1SP), while the control had twice as much true protein. It is important to note that the amount of real protein was higher in the treatment with 0.5% urea compared to the treatment with 2% Benural. Of course, the situation is completely reversed with non-protein nitrogen (NPN - Non Protein Nitrogen) when it has the most in silage with the addition of 1% urea (737.87 g / kg-1SP), and the least in the control treatment (441.20 g / kg-1SP). Differences between treatments for the amount of true protein and for the amount of nonprotein nitrogen were statistically significant (Table 2). The addition of non-protein nitrogen to corn silage significantly reduces the share of insoluble proteins (IP). The most insoluble proteins had control, and the least treatment with 1% urea. Treatments differed significantly from each other, P <0.01. During the study, an average of 11.28 gkg-1 NDICP (Neutral Detergent Insoluble Crude Protein) was found to be highest in control silage and lowest in silage with 1% urea and 2% Benural (Table 2). Silage samples with Benural and 1% urea did not differ statistically significantly. The variation range for this trait is 9.5 - 15.8 gkg-1 similar values are reported by Fox et al. (2004), but with a slightly smaller interval of variation of 12-16 gkg-1. The unavailable protein for ruminants ADICP (Acid Detergent Insoluble Crude Protein) was highest in control silage 9.82 gkg-1CP and lowest in silage with 1% urea 8.23 gkg-1CP. Fox et al. (2003) found values of 4.5 -7.0 gkg-1. Treatments with benural and 0.5% urea do not differ, and control and treatment with 1% urea differ significantly, P > 0.01.

The average amount of soluble proteins (SoIP-soluble proteins) was 635.53 gkg-1SP and with the addition of NPN

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compounds it increased (Table 2). Differences between treatments ranged from 490.2 gkg·1SP in control silage to 746.73 gkg·1SP in silage with 1% urea. The differences are statistically significant P <0.05, all observed treatments differ from each other for this feature. Fox et al (2004) found, for whole plant corn silage, that the value of soluble protein (Sol.P) was 53% of the total amount of protein. The values in our research are from 49 to 74.7%.

Table 2. Primary protein fractions in whole plant corn silages

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Benural 1%</th>
<th>Benural 2%</th>
<th>Urea 0.5 %</th>
<th>Urea 1 %</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM, gkg⁻¹</td>
<td>345.8ᵇ</td>
<td>355.7ᵃ</td>
<td>341.5ᵇ</td>
<td>322.7ᶜ</td>
<td>327.8ᵉ</td>
<td>340.7₀</td>
</tr>
<tr>
<td>CP, gkg⁻¹DM</td>
<td>77.5ᵃ</td>
<td>107.5ᵈ</td>
<td>138.2ᵇ</td>
<td>119.3ᶜ</td>
<td>158.4ᵃ</td>
<td>106.3ᵇ</td>
</tr>
<tr>
<td>TP,gkg⁻¹CP</td>
<td>558.8ᵃ</td>
<td>429.1ᵇ</td>
<td>330.5ᵈ</td>
<td>358.0ᵇ</td>
<td>262.1ᶜ</td>
<td>387.7ᵇ</td>
</tr>
<tr>
<td>NPN,gkg⁻¹CP</td>
<td>441.2ᵃ</td>
<td>570.8ᵈ</td>
<td>669.4ᵇ</td>
<td>641.9ᵇ</td>
<td>737.8ᵃ</td>
<td>612.2ᵇ</td>
</tr>
<tr>
<td>IP,gkg⁻¹CP</td>
<td>509.8ᵃ</td>
<td>403.8ᵇ</td>
<td>310.0ᵈ</td>
<td>345.3ᵇ</td>
<td>253.2ᵇ</td>
<td>364.4ᵇ</td>
</tr>
<tr>
<td>NDICP,gkg⁻¹CP</td>
<td>15.7ᵃ</td>
<td>10.1ᵇ</td>
<td>9.4ᶜ</td>
<td>11.6ᵇ</td>
<td>9.3ᵇ</td>
<td>11.2ᵃ</td>
</tr>
<tr>
<td>ADICP,gkg⁻¹CP</td>
<td>9.8ᵃ</td>
<td>9.3ᵇ</td>
<td>8.5ᵇ</td>
<td>8.4ᵇ</td>
<td>8.2ᶜ</td>
<td>8.8ᵃ</td>
</tr>
<tr>
<td>SolP,gkg⁻¹CP</td>
<td>490.2ᵇ</td>
<td>596.1ᵈ</td>
<td>689.9ᵇ</td>
<td>654.6ᵇ</td>
<td>746.7ᵃ</td>
<td>635.5ᵇ</td>
</tr>
</tbody>
</table>

a, b, c, d, e homogeneous groups within which there are no significant differences, and between which the differences are significant (P <0.05)

dm-dry matter, cp-crude proteins, ndicp-neutral spawning. cp in detergent
ip-insoluble prot, soip-soluble prot., adicp-insoluble raw detergent
tp-true proteins, npn-non-protein nitrogen, pa, pb, pc-fractions of soluble proteins

During the analysis of crude protein degradation, it was found that during the addition of NPN compounds to the silage of the whole plant, it was dominated by the PA fraction (611.5 gkg·1SP), then the PB2 subfraction (259.24 gkg·1CP). The PC fraction, and especially the PB1 and PB3 subfractions, are significantly less represented. Table 3 shows the degradability results of crude proteins, with the highest degradability found in the PA fraction. The values of this fraction increase from control silage to silages with higher addition of NPN compounds and they range from 441.2 gkg·1SP (control) to 733.8 gkg·1CP (treatment with 1% urea). Fraction B (PB1, PB2, PB3) as well as the PC fraction are reduced with the addition of NPN compounds. The largest amount of protein fractions of PB and PC was determined in the control silage. In the PB1 subfraction, statistical significance was found between control silage and all other treatments. In the subfraction PB2 and PB3, three homogeneous groups are distinguished, while in the subfraction PA and PC, all treatments differ significantly from each other (P <0.05).

Table 3. Fractions of degradable crude proteins in whole plant corn silages

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Benural 1%</th>
<th>Benural 2%</th>
<th>Urea 0.5 %</th>
<th>Urea 1 %</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA gkg⁻¹CP</td>
<td>441.2ᵃ</td>
<td>570.8ᵇ</td>
<td>669.4ᵇ</td>
<td>641.9ᵇ</td>
<td>733.8ᵃ</td>
<td>611.4ᵇ</td>
</tr>
<tr>
<td>PB1 gkg⁻¹CP</td>
<td>48.9ᵃ</td>
<td>25.3ᵇ</td>
<td>20.4ᵇ</td>
<td>12.7ᵇ</td>
<td>12.8ᵇ</td>
<td>24.0ᵇ</td>
</tr>
<tr>
<td>PB2 gkg⁻¹CP</td>
<td>305.7ᵃ</td>
<td>309.3ᵇ</td>
<td>241.4ᵇ</td>
<td>247.9ᵇ</td>
<td>191.7ᵇ</td>
<td>259.2ᵇ</td>
</tr>
<tr>
<td>PB3 gkg⁻¹CP</td>
<td>77.4ᵃ</td>
<td>7.7ᵇc</td>
<td>6.5ᵇ</td>
<td>26.5ᵇ</td>
<td>9.4ᵇc</td>
<td>25.5ᵇ</td>
</tr>
<tr>
<td>PC, gkg⁻¹CP</td>
<td>126.6ᵃ</td>
<td>86.8ᵇ</td>
<td>62.0ᵇ</td>
<td>70.9ᵇ</td>
<td>52.1ᵇ</td>
<td>79.7ᵇ</td>
</tr>
</tbody>
</table>

- Carbohydrate content in silage

The addition of non-protein nitrogen (Benural, urea) to the corn silage of the whole plant affected the content and fractions of carbohydrates in the silage. Table 4 provides data on total (CHO) and non-structural carbohydrates (NFC). The highest values of total and unstructured carbohydrates were determined in the control, and the lowest in the treatment with the addition of 2% Benural. The addition of NPN additives to the corn silage significantly affected the reduction of CHO compared to the control. According to the amount of total carbohydrates, treatments with 1% Benural and 0.5% urea do not differ from each other. There is also no significant difference between treatments with 2% Benural and 1% urea, while control differs significantly from other treatments. When it comes to unstructured carbohydrates, treatments show different dependencies (Table 4).

Table 4. Carbohydrate content and digestibility in corn silage of the whole plant

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Benural 1%</th>
<th>Benural 2%</th>
<th>Urea 0.5 %</th>
<th>Urea 1 %</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHO gkg⁻¹</td>
<td>841.5ᵃ</td>
<td>806.4ᵇ</td>
<td>767.3ᶜ</td>
<td>803.4ᵇ</td>
<td>768.3ᶜ</td>
<td>797.4ᵇ</td>
</tr>
</tbody>
</table>

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The highest and lowest NDF content was determined in treatments with the addition of urea. Most NDF (538.33 gkg⁻¹) had treatment with 0.5% urea, and the lowest content was found in treatments with 1% urea (492.95 gkg⁻¹). From the obtained results, it can be concluded that there is no regular trend of changes in NDF depending on the change in the share of NPN additives in silage biomass. With the increase in the amount of added benural in the silage from 1% to 2%, there was a significant increase in NDF, while the increase in the amount of urea from 0.5% to 1% had the opposite effect on the same observed parameter. These results are within the limits of the results obtained by Jovanović (2006) in whose research the value of NDF ranges from 486.2-525.0 gkg⁻¹ from SM. Slightly lower values are stated by Stojanović and Grubić (2008). The addition of urea and benural significantly affected the ADF concentration, which is highest in silage with 0.5% urea (268.6 gkg⁻¹SM) and lowest in silage with 1% benural (245.5 gkg⁻¹SM). If we compare the trends of changes in ADF and NDF, we can see the similarity of the changes through treatment. Similar to NDF, an increase in the addition of urea in the silage led to an increase in ADF, while an increase in the share of benural had the opposite effect, ie. led to a decrease in ADF. Jovanović (2006) in his research states the values for ADF from 233.1 to 274.6 gkg⁻¹ASM.

The lignin content ranged from 36.52 gkg⁻¹SM in control silage to 44.83 gkg⁻¹SM in silage with 1.0% urea (Table 4). Observed in relation to the control silage, all silages with NPN supplementation had a significantly higher level of ADL, where the increase in the concentration of benural, ie urea led to an increase in ADL, relative to benural. The concentration of lignin in the silages of 13 maize hybrids examined by Jovanović (2006) ranges from 29.3-47.9 gkg⁻¹, which in relation to our results shows somewhat higher but also significantly lower values. The digestibility in our tests is somewhat higher in relation to the results of Jovanović (2006) where the digestibility of 13 maize hybrids ranges from 55.39-61.70%. Such values in our tests (59.81-63.18%) are probably the result of favorable climatic conditions for the development of the corn plant in 2014, with an increased share of grains and non-structural carbohydrates. The results of the digestibility of organic and dry matter in the studies of O’Kiely and Moloney (1997), which ranged from 60.9 to 61.2% SM, are also within the limits of these tests.

IV. CONCLUSION

The addition of maize silage to the whole plant of non-protein nitrogen (Benural and urea) had an effect on the content of protein and sugar fractions in silage. The addition of NPN compounds reduced the concentration of lignin (about 10%) and the amount of insoluble protein (IP) decrease with the addition of NPN compounds. The amount of non-protein nitrogen in the silage increases with the addition of NPN compounds. Proteins that are determined from the residue after treatment with neutral detergent (NDICP), as well as proteins that are determined after treatment with acid detergent (ADICP) are in small quantities (about 10-15 gkg⁻¹SM), which is desirable for silage. By adding NPN compounds, these proteins are reduced. The soluble protein fraction (SolP) increased with the addition of non-protein compounds from 490.2 gkg⁻¹SP in control to 746.73 gkg⁻¹SP in silage with 1% urea. It was found that within the crude proteins, the PA fraction (61.1%) dominates, followed by the PB2 fraction (25.9%), while there are significantly fewer other fractions. The PA fraction, which has high degradability, tends to increase from silage without additives (control) to silage with the highest additives of NPN compounds (1% urea). Unlike the PA fraction, the other PB fractions (subfractions PB1, PB2 PB3), and especially the PC fraction are characterized by a decrease in value with the addition of NPN compounds. Total and unstructured carbohydrates decreased with the addition of non-protein nitrogen. The addition of 0.5% urea had a positive effect on the amount of NDF, ADF, and ADL, while the addition of 1% urea had a positive effect on the digestibility of silage. The general conclusion is that the addition of NPN compounds to whole plant corn silage contributes to an increase in crude protein content and an increase in digestibility. The addition of these compounds does not negatively affect the fermentation process, on the contrary, it consumes the excess sugar left in the silage. In this way, lactic acid bacteria are influenced to produce more lactic acid, which increases the stability of the silage, by preventing subsequent fermentation caused by yeasts and molds, using that residual sugar in the silage.

REFERENCES


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The Effect of Financial Technology, Company Characteristics and Owner Characteristics on MSME Financial Decisions in Bali Province

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** Faculty of Economics and Business, Udayana University, Bali, Indonesia

Abstract - This study aims to determine how the effect of financial technology, company characteristics and owner characteristics on financial decisions. The population of this research is the MSMEs in Bali Province with a total of 481,853 units. The number of samples in this study were 100 respondents who were determined based on the Slovin formula with a critical value of 10 percent. The sampling technique used was purposive sampling method based on MSMEs that know about Fintech lending, namely online lending and borrowing services. The method of collecting data through a questionnaire. The data analysis technique used is multiple linear regression analysis and previously carried out factor analysis to determine indicators that can represent variables seen from the highest MSA (Measure of Sampling Adequacy) value. The results of this study indicate that financial technology, company characteristics and owner characteristics have a positive effect on financial decisions.

Keywords: Financial Decisions, Financial Technology, Company Characteristics, Owner Characteristics

I. INTRODUCTION

The problem of financing is an important aspect in determining the sustainability of the company and as a basis for making financial decisions by companies, including MSMEs. A company financial decision is a decision made by a financial manager relating to how to finance investment decisions to be made and determining the composition and source of financial (Kumar, 2012). The financial decision, according to Suad Husnan and Pudjiastuti (2015: 277), concerns the form and composition of the financial that the company will use. This decision is a financial management decision in considering and analyzing the most economical mix of sources of funds for the company to finance investment needs and operational activities. Financial decisions cover two important things, first, about where company funds are met and second, related to the analysis of the cost of capital used by the company (Wisastini, 2014: 207). In his book, Sartono (2016: 301) states that the sources of funds are divided into time, namely short, medium and long term. According to research conducted by Nugroho (2010), these sources of financial can be grouped into two, namely internal sources of funds and external sources of funds. Internal sources of funds come from the owners themselves and external sources of funds come from outside the business owners, both formal and informal. Practically, in selecting the source of company financial according to Riyanto in Wiagustini (2014: 223-228), it is divided into three forms of analysis. First, the analysis of the approach to economic profitability and equity profitability, which is related to the use of debt, can provide higher returns than interest on the debt. The second is the analysis of the liquidity approach, which relates to whether the use of debt can cause liquidity difficulties or not. The third is cash flow analysis, namely the approach to using debt by considering the ability to pay on time. Avery et al. (1998) explained that the main and most important sources of financial for start-up companies are funds from the owner of the company and informal external loans. The study conducted by Rossi et al. (2016) found that special financial sources for small and medium enterprises are divided into two, namely internal sources and external sources. Internal sources include financial from retained earnings, asset sales and reduced inventories, while external sources include loans from short, medium and long-term creditors.

Apart from education, the gender of the business owner plays an important role in financial decisions The gender of micro and small business actors can differentiate opportunities in accessing financial. Based on the results of the continued 2016 Economic Census analysis, that the chances of male MSME owners in Bali to access financial is 1.47 times higher than that of women (BPS, 2019a). Female owners are considered to face more difficulties in accessing financial than men (Blackburn, 2013). In Sri Lanka, female owners have less access to external financial to fulfil their business (Kuruppu & Azeez, 2016). Coleman (2000) found that women entrepreneurs prefer to avoid external financial due to a strong desire not to have obligations with others. Along with the development of information technology, other factors become important in making decisions about sources of funds for companies, especially MSMEs. The government, through the Financial Services Authority (OJK), assesses that digital financial services are a solution that can save the
sustainability of MSMEs from difficult access to finance (Rizal, 2018). Chairman of the OJK Board of Commissioners Wimboh Santoso said that digital financial services could make it easier for people to make transactions and to obtain financing. This digital financial service is called financial technology or abbreviated as Fintech (Ahad, 2017). Based on the Bank Indonesia Financial Stability Study (2017a), Fintech is considered capable of reaching people who have not had access to finance by banks. The type of Fintech service in Indonesia that is widely used is Fintech lending, also known as Peer to Peer Lending (P2PL), which is an online loan service. Fintech lending is a financing platform that is considered capable of reaching the MSME sector as an alternative source of external financial (Ardiansyah, 2019). Fintech lending is proven to be an alternative solution in meeting short-term financing needs (Gibilaro & Mattarocci, 2018). According to Urban's research (2019), an easy and fast process is the dominant factor for MSMEs in making loan decisions through Fintech. This fintech lending can be alternative financing with lower transaction costs because the loan process is carried out online and can reduce information asymmetry (Xiang, 2018).

The Indonesian Joint Financial Fintech Association (AFPI) has regulated in a code of conduct that the total loan cost does not exceed a flat interest rate of 0.8 per cent per day. There is also a stipulation that the total amount of fees, late fees, and all other fees is a maximum of 100 per cent of the principal value of the loan. Based on data published by the Financial Services Authority (OJK), it shows the rapid growth of Fintech lending in Indonesia. The accumulated distribution of loans nationally until January was Rp.88.37 trillion with a national accumulation of borrower accounts of 20,497,167 entities with 164 Fintech lending companies registered or licensed by OJK Regulation No. 77 of 2016 (OJK, 2020). This condition shows that the availability of Fintech lending in Indonesia can assist the government in providing financial services and loans that are broader and more efficient. Based on the results of research conducted by Huang (2020), it is stated that the development of digital financial access has a positive and significant effect on alleviating the constraints of financing for MSMEs. The same results were also found in Hakim Ghazali’s (2018) research that the existence of Fintech lending has a positive effect on financing problems in Malaysia.

Fintech can be an alternative financing option that can stimulate business activities in Malaysia. In contrast to Sybirianska et al. (2018) which shows that the existence of Fintech lending has not been effectively utilized as an alternative to financing MSMEs in Ukraine. Analysis of the Ukrainian tech market found that more than 60 percent of Fintech lending platforms were launched in the past three years, but their usage has not been maximized. Seeing the importance of financial decisions and the factors that influence them, this study aims to see how the influence of Fintech, company characteristics and owner characteristics on financial decisions focused on the MSME sector in Bali Province. Based on the explanation above, the hypotheses that can be stated are:

- H1: Financial technology has a positive and significant effect on financial decisions.
- H2: Company characteristics have a positive and significant effect on financial decisions.
- H3: Owner characteristics have a positive and significant effect on financial decisions

II. METHODS

This research was conducted in Bali Province by making nine areas as the focus. The areas referred to in this study are Klungkung Regency, Karangasem Regency, Jembrana Regency, Singaraja Regency, Tabanan Regency, Badung Regency, Gianyar Regency, Bangli Regency and Denpasar City. The location of this research was chosen because it saw the suitability of the topics and problems raised, namely in the MSMEs sector. The existence of MSMEs is one of the sectors driving the economy in Bali Province with a total of 481,853 MSMEs and of course it can represent research carried out related to financial decisions (BPS, 2019b).

The population in this study were 481,853 MSMEs units in Bali Province. The sampling method is divided into two ways, namely probability sampling and non-probability sampling. This study uses a non-probability sampling method in determining the sample. Non-probability sampling is a non-random sampling method that does not provide equal opportunities or opportunities for all elements or members of the population to be selected as samples. The sample size used as a respondent is determined based on population size. The samples taken in this study were 100 MSMEs units which were determined using the Slovin approach. The Slovin formula used is as follows.

\[ n = \frac{N}{1 + Ne^2} \]
The calculation of the number of samples in the study using the Slovin approach is as follows:

\[ n = \frac{N}{1 + Ne^2} \]

\[ n = \frac{481.853}{1 + 481.853 (0.1)^2} \]

\[ n = \frac{481.853}{481.853} \]

\[ n = 4.819.53 \]

\[ n = 99.98 (100). \]

The number of samples used is 100 MSMEs units, so that the population can be fully represented, the sampling is based on districts and cities in Bali Province. The data were collected using a research instrument in the form of a questionnaire that was distributed directly to the respondents. The questionnaire in this study was measured based on the respective measurement scales of each variable studied. This study uses qualitative data which will later be quantified with a measurement scale of each variable so that it can be processed using regression analysis with the help of SPSS. This study uses multiple linear regression, namely the analysis used to determine the effect of financial technology, company characteristics and owner characteristics on financial decisions. Here is a form of multiple linear regression equation used in the study.

\[ Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e \]

A. Multiple Linear Regression Analysis Test Results

The multiple linear regression model testing in this study uses three independent variables, namely financial technology, company characteristics, and owner characteristics and one dependent variable, namely the financial decision. Table 1 presents the results of the SPSS multiple linear regression analysis for this research model.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>-0.822</td>
<td>-0.822</td>
</tr>
<tr>
<td>Financial Technology (X1)</td>
<td>0.392</td>
<td>0.392</td>
</tr>
<tr>
<td>Company Characteristics (X2)</td>
<td>0.263</td>
<td>0.263</td>
</tr>
<tr>
<td>Owner’s Characteristics (X3)</td>
<td>0.271</td>
<td>0.271</td>
</tr>
</tbody>
</table>

Primary Data, 2020

The unstandardized coefficients from the results of the multiple linear regression test in Table 1 can form the regression equation in this study as follows.

\[ Y = -0.822 + 0.392 (X1) + 0.263 (X2) + 0.271 (X3) \]

B. Simultaneous testing (F test)

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The F test is conducted to determine the effect and significance of all independent variables on the dependent variable simultaneously (simultaneously). The results of the F test which states the significance of F or probabilities value <0.05, the relationship between the independent variables is a significant influence on MSME financial decisions in Bali Province and the model used in this study is said to be feasible. The results of the F test are presented in Table 2 as follows:

<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>25,626</td>
<td>3</td>
<td>8,542</td>
<td>13,649</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>60,080</td>
<td>96</td>
<td>0,626</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>85,706</td>
<td>99</td>
<td></td>
<td></td>
<td>0.000</td>
</tr>
</tbody>
</table>

Based on Table 2, it can be seen that the significance value of the F test is 0.000, which means that it is smaller than 0.05, the F test hypothesis is accepted, namely financial technology (X1), company characteristics (X2), and owner characteristics (X3) simultaneously or simultaneously have an effect on the financial decision (Y) of MSMES in Bali Province and the model used in this study is said to be feasible.

C. Partial testing (t test)

The t test is performed to show the effect and significance of each independent variable on the dependent variable or partial testing. The partial influence of financial technology, company characteristics and owner characteristics on MSME financial decisions in Bali Province can be seen through the significance value or probability value of 5% or 0.05. Conclusion drawing is done with the criteria if the significance value is <0.05 then financial technology, company characteristics, and owner characteristics partially affect the financial decisions of MSMEs in Bali Province (hypothesis is accepted). On the other hand, if the significant value is > 0.05, then financial technology, company characteristics, and owner characteristics do not partially affect MSME financial decisions in Bali Province (hypothesis is rejected). The t test results are shown in Table 3 as follows:

<table>
<thead>
<tr>
<th>Variabel</th>
<th>t</th>
<th>Sig. Uji t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Technology (X1)</td>
<td>2.539</td>
<td>0.013</td>
</tr>
<tr>
<td>Company Characteristics (X2)</td>
<td>3.805</td>
<td>0.000</td>
</tr>
<tr>
<td>Owner’s Characteristics (X3)</td>
<td>4.819</td>
<td>0.000</td>
</tr>
</tbody>
</table>

D. The effect of financial technology on financial decisions (H1)

Based on the results of the analysis in Table 3, it shows that financial technology has a significance value of 0.013, which is smaller than 0.05, so that the hypothesis can be accepted. Therefore it can be concluded that there is an influence of financial technology on MSME financial decisions in Bali Province. This means that the development and existence of this Fintech lending can be reached as an alternative financial for MSMEs in provinces that have difficulties in accessing finance.

This study found that financial technology has a positive effect on MSME financial decisions in Bali Province. The results of this study indicate that financial technology, which is measured by the use of Fintech lending indicators, offers lower transaction costs, which is an alternative source of financial for MSMEs in Bali Province. This means that the transaction fees offered by Fintech lending make it more accessible to the MSME sector in Bali Province as an alternative source of financial.

The development of Fintech lending in Bali can certainly be a solution to the financial problems experienced by MSMEs so far. The existence of this fintech lending can reach and become a bridge for MSMEs in Bali in obtaining financial sources for the sustainability of their business. The results of this study are also supported by research conducted by Ardiansyah (2019), Huang (2019) and Ghazali (2018) which states that there is a positive effect of Fintech lending on MSME financial decisions

E. The Effect of company characteristics on financial decisions (H2)

Based on the results of the analysis in Table 3, it shows that the characteristics of the company have a significance value of 0.000, which means it is smaller than 0.05, so the hypothesis is accepted. It can be concluded that there is an influence of company characteristics on
MSME financial decisions in Bali Province. This means that the characteristics of MSMEs determine the decision to use the source of funds used in running their business.

This study found that company characteristics have a positive effect on MSME financial decisions in Bali Province. The results of this study indicate that the characteristics of the company as measured by the size indicator of MSMEs, namely based on the number of employees or workers, affect the financial decisions for MSMEs in Bali Province. The size of the MSMEs that is getting bigger increases the decision to finance MSMEs in Bali to use more debt. The larger size of MSMEs as measured by the number of employees makes MSMEs have higher work productivity in producing products, thus requiring large financial to finance them. The limited capital owned by MSMEs makes debt an alternative source of financial.

The influence of company characteristics on financial decisions means that the larger the company size, the higher the use of external sources of funds. When the company grows, the higher the need for its use of funds. The results of this study are also supported by research conducted by Zunckel (2019), Fachrudin (2018), (Wasuuzzaman & Nurdin (2019) and Prastikaa (2019) which states that there is a positive influence on company characteristics on MSME financial decisions.

**F. The Effect of owner characteristics on financial decisions (H3)**

The results of the analysis in Table 3 show that the characteristics of the owner have a significance value of 0.000, which means less than 0.05, so the hypothesis is accepted. Thus it can be concluded that there is an effect of owner characteristics on MSME financial decisions in Bali Province. This means that MSME owners have an important role in determining or making decisions regarding the use of sources of funds in running their business.

This study found that owner characteristics have a positive effect on MSME financial decisions in Bali Province. This study shows that the owner characteristics as measured by the owner's education level indicator influence the MSME financial decisions in Bali Province. MSME owners who have higher education can increase their financial decisions using more debt. Higher education for MSME owners shows increased insight in innovating both in product, process and marketing innovations so that it requires large financial. The limited capital owned by MSMEs makes financial originating from debt an alternative.

The effect of owner characteristics on financial decisions, meaning that the higher the level of education of business owners, the greater the opportunity to access financial. The higher level of education of the business owner provides greater confidence in dealing with external parties when making financial requests. This education affects the owner's attitude in making financial decisions. The owner's high education level tends to have a better ability in doing financial planning. The results of this study are also supported by research conducted by Rasheed (2018), Kuruppu & Azeez (2016) and Rossi et al. (2016) which states that there is a positive influence on owner characteristics on MSME financial decisions.

**G. Determination Coefficient Testing (R²)**

The coefficient of determination measures the extent to which the variance of the independent variable is able to explain the variance of the dependent variable. In this study, the coefficient of determination is indicated by the adjusted R square value. The results of the coefficient of determination test can be shown in Table 4 below:

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.547³</td>
<td>0.299</td>
<td>0.277</td>
<td>0.79110</td>
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</tbody>
</table>

Primary Data, 2020

Based on Table 4, it can be seen that the adjusted R square value of this study is 0.277 or 27.7 percent. This value means that 27.7 percent of the variance of MSME financial decisions in Bali Province can be explained or influenced by financial technology, company characteristics, and owner characteristics. The remaining 72.3 percent is explained or influenced by other variables not explained in this study.

**IV. CONCLUSION**

Theoretically, this research can provide scientific contributions and empirical evidence that financial decisions are influenced by technological developments in digital financial services called financial technology, company characteristics and company owner characteristics. This study found that financial technology, company characteristics, and owner characteristics had a positive effect on financial decisions. Based on these findings, this research has practical implications that financial technology, company characteristics,
and owner characteristics can be taken into consideration in making financial decisions by the MSME sector in Bali Province. For MSMEs in Bali Province, the results of this study are expected to increase the ability to use technology in the field of digital-based financial services such as financial technology, so that it can help in business processes.
Research Limitations

The existence of limited time and conditions, this study is limited to only taking 100 samples from the total population of MSMEs in Bali Province. Further researchers are advised to use a larger sample so that they can represent more of the MSME population in Bali Province.

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The Positive Mediating Impact of Teacher Helping Behaviour on HPWS and Teacher Performance in SHRM

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Abstract- Incorporating the strategic human resource management research with teaching staff views of their performance. In this study, it proposed that the human resource management practices of a high-performance work system enhance teacher performance in the school context. However, the integration of Helping Behaviour as a mediator between HPWS and Teacher performance encourage teachers to engage in cooperative behaviors among their colleagues and the students who are essential in achieving its superior performance. The results based on the data from six education district in Lagos State Nigeria. The 322 teachers significantly embraced the proposed theoretical framework and enliven the effect of a teacher helping behavior on high-performance work system and teacher performance adopting Structural Equation Modelling (SEM) analysis. Results of the analysis revealed that collective teacher Helping Behaviour moderated the link between HPWS and Teacher Performance indirectly. Consequently, HPWS directly influenced the teacher performance.

Index Terms- Helping Behaviour, High-Performance Work System (HPWS), SHRM, Teacher Performance

I. INTRODUCTION

The continuous expeditious change that rocks the Economic environment globally is characterized to reshape customers, investors’ demands, and high increasing product-market competitions. However, in order to compete successfully in this environment, organizations need continuous improvement of their performance by reducing costs, innovating products and improving quality of their products. Meanwhile, human resources are considered to be one of the most valuable resources of today’s establishment. The way of managing employee is becoming more significant because many other sources of competitive success are less potent to meet up the market challenges. Therefore new mechanism should be developed as a tool for human resource management and strategy.

This paper examines the relationship that might exist between high-performance work system (HPWS) of strategic Human Resource practice and teacher effectiveness. Researchers of strategic human resource management (SHRM) has found a positive relationship between high-performance work systems (HPWS) and employee performance (Boxall & Macky, 2016; Combs, Liu, Hall, & Ketchen, 2006). However, the introduction of a teacher helping behavior paradigm in the education ministry might facilitate inner drive of the individual that enhance quality performance.

The researcher contest that helping behavior is one of the important missing factors within the school system among the teaching staff and likewise the policy makers within the ministry. The amalgamation of HR systems and employee helping behavior could offer a more coherent understanding of how helping can be exploited in various circumstances. Strategic HR researchers such as Collins & Smith (2006) proclaim that through appropriate HR systems, organizations can influence employees’ behaviors and build social capital as a potential source of competitive. Based on this discussion, the researcher proposed the hypothesized model and hypothesis for this study as shown in Figure 1.
II. HIGH-PERFORMANCE WORK SYSTEM (HPWS)

Early before now, organizations are facing increased competitive challenges due to globalization, rapid technological advancement, greater innovation, demands for higher quality product and customer service, the risks and rewards of managing a diverse workforce. To meet up with these challenges and sustain a competitive advantage; organizations must combine human resource (HR) practices into an overall High-Performance Work Systems (HPWS) that enhances employee involvement and performance. According to Datta, Guthrie & Wright (2005), organizations that use HPWSs or systems of HR practices designed to enhance staff competencies, motivation, and performance associated with lower employee turnover, higher labor productivity, and improved overall organization performance.

Also, it has been introduced into literature as a bundle of HR practices which are being used in different combinations according to culture, climate and business strategies of the organization. HR practices shape the employee’s behavior and attitude toward the organization strategies and goals (Guzzo & Noonan, 1994). These practices are known by various names according to their use and circumstances like (a) High-performance Management (b) high involvement management(c) high commitment management (Hegan, 2006). The revolution in workplace gives more popularity of HPWS, reflecting the increasing number of the organization taking proactive steps to apply some form of HPWS (Nadler, 1992) and it also develops a psychological link between employees and employer by creating trust in each other (Arthur, 1994; Pfeffer, 1996).

HPWS is a combination of HR practices such as skill training, compensation policy, and workforce participation that complement organizational work structures and processes. It also maximizes responsibility, compliance, and adaptability of employees (Bohlander & Snell, 2010). HPWSs focus on systemization of the interrelated parts of an organization that complements one another to accomplish the goals of the organization. So, the HPWS elements can have a direct influence on teacher performance. At the same time, the effect could be another way round through helping behavior as the mediator variables. The combination of these variables can also have a positive effect on teacher performance which will result to reshape school performance in general.

The investigation has shown that there is a relationship between HRM practices and organizational outcomes such as organizational performance, productivity, financial performance, innovation and employees’ turnover (Huselid, 1995). It was noted that larger organizations are more likely to engage in best practice selection, due to the associated costs of selection as a best practice, often meaning that the smaller organization is unable to meet the required costs of meeting the best practice selection requirements (Johnson, 2000). It is interesting to note, however, that even though there are significant costs associated with recruiting and selecting the most appropriate employee for the job, long-term, costs that could be saved due to making optimal appointments that are important, and could thus outweigh any initial costs associated with finding an appropriate employee.

Besides, the recruitment channels that are selected to locate the employee often have a significant bearing on his caliber and the organization. Decisions must be made as to whether an agency is used, or whether methods including newspaper advertisements, professional magazine advertising, internet recruitment, or headhunting locally, nationally or internationally are utilized for example. This decision will impact on the resulting appointment and therefore must carefully be considered to ensure the most appropriate appointees are selected.

Therefore, training should be packed in more comprehensive and goal-oriented manner that should be more than a reference to the specific operational task. The development of employees in multiple ways is a method for instilling commitment,
as feedback of this undertaking can be felt through the employees improved performance. So, the enactment of effective training and development within an organization is highly essential for her goals to be realized (Enz & Siguaw 2000).

III. SHRM AND TEACHER PERFORMANCE

Over the years, studies linked HRM practices and employee job performance, a larger number of researchers, was conducted on different parameters of the various countries (Munjuri, 2011; Boon, Den Hartog, Boselie, 2011; Karatepe, 2013, Sattar, Ahmad & Hassan, 2015; Hassan, 2016). Most of their investigations showed a significant impact of SHRM practices on the performance of employees. Teacher performance is linked directly to School organizational performance. Therefore, successful school organizations consider the HRM practices as a crucial factor that directly affects the teachers’ performance.

The practices of SHRM structure is a magnificent tool that can play a vital role in enhancing various HR practices. Inadequate staff recruitment, lack of training and weak compensation schemes for excellent job performance are determinants part of employees performance and their engagement at the workplace (Zheng and Lamond, 2010). On the other hand, Andrew and Sofian, (2012) cited that various SHRM practices such as freedom of performance, teamwork, engagement, and compensation also provide the placement of motivated and competent employees. Therefore, the intervention of SHRM are interrelated with the organizational development which largely contributes towards high levels of productivity and high-quality performance in organizations.

IV. TEACHER HELPING BEHAVIOUR

The advancement intensity on the need for partnership, participation and the combination of joint-effort is highly critical in every organization for the effectiveness of interpersonal behaviors among employees (Griffin, Neal, & Parker, 2007; Ilgen & Pulakos, 1999). Moreover, likewise, the increasing globalization necessitates the sharing of information, products, and services, across cultures. Such sharing mostly builds upon employees’ cooperation and their willingness to help each other propelling the organization attains the set targets. Hence, helping behavior is an inevitable entity that is strongly needed in organizational success. Helping behavior is among significant determinant success of the group and organizational performance (Podsakoff, Whiting, Podsakoff & Blume, 2009; Podsakoff, MacKenzie, Paine, & Bachrach, 2000).

Moreover, has become more important in light of movement toward greater employee involvement, while Boxall & Macky (2009) observe it as interactive work structures and human resource flexibility within organizations. However, the helping behavior involves actions by which individuals positively affect others. In addition, Becker & Huselid (2011), have suggested a need to understand better HR systems’ influence on employees and relationships formed among them and also argued that HR systems may affect employees’ climate perception by symbolically signaling and directly communicating key organizational norms and values. Aside from that, the crucial aspect of HR systems most directly upon employees in a collective manner, since their responsibility is to manage the potential resources of the organization.

Also, empirical evidence also shows that employees are inclined to engage in extra-role, contextual performance if they perceive a high level of support from the organization (Rhoades & Eisenberger, 2002). For example, Piercy, Cravens, Lane, and Vorhies (2006) showed that salespersons’ perceptions of the organization’s concern for them could predict their performance. Extending Piercy et al. from the individual level of analysis to the unit level of analysis, then it can be proclaimed that once a shared perception about the unit’s concern for employees is formed at the unit level, then a shared reciprocal obligation will emerge at the unit level. Which will induce not only in-role collective service performance but also collective employee behaviors to contribute above the call of duty and engage in helping behavior toward coworkers.

Summarily, it has argued that the HR practices of an HPWS can facilitate dual climates of concern for customers and at the same time concern for employees, which in turn may encourage employees to engage in service performance and helping behavior that is essential for achieving superior teacher performance. The hypothesized model is rooted from the insight that HPWS and teacher performance could be influenced indirectly through helping behavior. Therefore, the researcher proposed the following hypothesis:

Proposed Hypothesis

H1: HPWS would be significantly related to teacher helping behavior.
H1b: HPWS would be significantly related to teacher helping behavior.
H2: Teacher helping behavior would be substantially related to teacher performance.

V. RESEARCH METHODOLOGY

This study is a quantitative survey using a questionnaire to get the opinion of government secondary schools teachers in Lagos State. Also, it can reach a significant number of people in a relatively quick amount of time and with minimal expenditure. The purpose of the survey was to provide adequate information on the perceptions of the teachers in Lagos State public schools regarding the role of how teacher helping behavior as a mediator variable can promote their job performance and HPWS respectively.

VI. DATA ANALYSIS PROCEDURES

The researcher makes use of CFA to test whether each of the measurement items stipulated could load significantly onto the latent constructs they belong. Moreover, also to determine whether each construct was empirically distinct from the other. Also, James, Mulaik, & Brett, (2006) suggested that Structural equation modeling was employed to provide a better balance of statistical power, that can simultaneously test both paths from an independent variable to a mediator. Moreover, likewise from the mediator to the dependent variable to examine the relationships proposed in the research model.
VII. DEMOGRAPHIC DATA

Data are collected directly from the teachers working in the government school Lagos state Nigeria. A total 410 respondents from the teacher were collected out of 600 questionnaires distributed among the six districts. However, 322 samples were fully answered of which 88 of respondents were rejected due to incomplete fill out of questionnaires. Finally, 322 samples are found suitable for analysis in this study.

Male respondents comprised of 25.5%, which means 82 of the total respondents, and female employees contributed 74.5% that is 240 of the total respondents. The study revealed that Majority of the participants (35.01%) had been employed for more than five years. 32.06% of employees had 6-10 years of work experience while 11.05% had 11-15 years of work experience. 7.05% of respondents had their experience of work between 16-20 years. However, 4.0% have been employed between 21-25 years while those with 26-30 years of experience are 6.2%. Additionally, 1.06%, .06%, and .09% have their work experience between 31-35 years, 36-40 years and 41 years above respectively. Furthermore, Out of 322 respondents, 187 were B.Ed/HND graduates, 99 were Diploma/OND/NCE graduate while only 36 had M.ED. Unfortunately, none of the interviewees had Doctoral Degree. More so, out of the total sample surveyed, 69.03% of teachers were within 1-5 years of training, 24.5% of respondents were within the age category of 6-10 years; 3.1% were within the range of 11-15 years; 1.9% and 1.2% were within the group of 16-20 and 21 years and above respectively.

VIII. RELIABILITY AND VALIDITY OF THE QUESTIONNAIRE

The validity of the questionnaire was tested using Exploratory Factor Analysis (EFA). The results of EFA indicated that three underlying factors, namely, HPWS, a teacher helping behavior as well as teacher performance as predicted. 30 items consist the three factors. The inter-correlation among the items tested the starting of EFA as indicated by anti-image matrices showed that all the elements correlations between themselves more than .857. Additionally, The Kaiser-Meyer-Olkin measure of sampling adequacy was .930, indicating the suitability of the data for EFA. Bartlett’s Test of Sphericity was revealed to be statistically significant (p = .000), which indicates the satisfactory correlation between the items.

Meanwhile, the total variance of three factors explained 56.744% which showed that the items were able to measure HPWS which include (Staffing, Training, and Compensation), Teacher Helping Behaviour and teacher performance. The highest Eigenvalue was obtained by the first factor of 10.840, while the other two factors showed the values of 1.7563 and 1.618, respectively. The majority of communities estimates for each of the items were greater than .68.

The rotated component matrix exhibited three solid components. The first element of HPWS was represented by the fourteen items indicating loadings ranging from .499 to .830 and explained 37.880% of the total variance. The second component of teacher behavior was represented by the four items showing loadings from .556 to .791 and explained 7.451% of the total variance. The last component of teacher performance was represented by the twelve items and demonstrated loadings ranging from .972 to .426 and explained 7.052% of the total variance.

IX. MEASUREMENT MODEL

After the assessment of the EFA, a measurement model of each construct was examined by reviewing the estimated factor loadings for statistical significance and by examining the composite reliability and the variance extracted from that construct. However, each of the measurement items specified could load significantly onto the latent constructs with which they were associated and each construct which ranges from (.46 to .80) as shown in Figure 2.

The results of CFA indicated that the hypothesized three-factor model fit the data well ($\chi^2$ = 59.855, df = 32, p = .002 < .005, RMSEA = .055, GFI = .963, AGFI = .936, NFI = .951, RFI = .931, CFI = .976, TLI = .966 and CFI = .976) this findings indicate that the model possesses adequate discriminate validity. The results of the correlation matrix of the latent variables suggests a relatively high level of correlation coefficient between HPWS and Teacher Performance ($r = .89$), as well as the Teacher Helping Behaviour which indicator mediator between HPWS and Teacher Performance ($r = .80$) and ($r = .80$) respectively indicating that the relationship between each indicator variable and its respective latent variable was statistically significant (p < .01) suggesting that constructs used in this study were distinct.
X. STRUCTURAL EQUATION MODELLING (SEM)

The employment of structural equation modeling provides a better balance of statistical power by simultaneously testing both paths from an independent variable to a mediator and from the mediator to the dependent variable (MacKinnon, Lockwood, Hoffman, West, & Sheets 2002) to examine the relationships proposed in the research model. Therefore, the structural model was assessed by adding the predicted paths to the measurement model. A direct path from HPWS to teacher performance is indicating that part of the causal effect of HPWS on the teacher performance and a mediation effect of Teacher helping behavior through HPWS and teacher performance. The hypothesized research model in Figure 3 achieved an acceptable fit with this data ($\chi^2 = 59.855$, df = 32, GFI = .963, AGFI = .936, NFI = .951, RFI = .931, IFI = .976, TLI = .966, CFI = .976 and RMSEA = .052).

Figure 2: CFA Measurement Model of the Hypothesized Model
In examining the structural parameter estimates, a strong positive relationship was found between the measure of HPWS and teacher performance ($\gamma = .80, p < .001$) as well as a strong positive relationship between the measure of HPWS and helping behaviour ($\gamma = .57, p < .001$) was statistically significant thus supporting Hypotheses 1 and 1b. Besides, it was found that the coefficients of the path from Teacher helping behaviour to teacher performance was also significant ($\gamma = .54, p = < .001$), therefore supporting Hypotheses 2.

The correlations estimate for structural equations was .888 for both HPWS and Teacher Performance, .803 for HPWS and Teacher Helping Behaviour as well as .797 for teacher performance and helping behavior, suggesting that the variance of all the variables were moderate as specified in the model as shown in Table 1.

**Table 1: Correlations Estimate**

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<th>Estimate</th>
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<tr>
<td>HPWS (&lt;--) TEACHER_PERFORM</td>
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</tr>
<tr>
<td>HPWS (--&gt;) ANCE</td>
<td>.803</td>
</tr>
<tr>
<td>TEACHER_PERFO (&lt;--) TEACHER_HELPING_</td>
<td>.797</td>
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<td>RMANCE (--&gt;) BEHAVIOUR</td>
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**XI. DISCUSSION OF THE STUDY**

To assess indirect relationships between HPWS and teacher performance, teacher helping behavior was introduced a mediator variables to test its effect on teacher performance. The results of the Structural Equation Model suggested that the relationship between HPWS and teacher performance cannot be only directional, but there are also indirect relationships that exist between them and helping behavior. Base on structural equation model result, it was observed that the direct effect on teachers performance and HPWS manifest it is, but effects through helping behavior.

According to the findings, the HPWS strongly facilitate helping behavior and enhances teachers’ performance. The findings also suggest that teachers helping behavior attitude subsequently promotes students’ knowledge, student performance and promote positive school climate. After that, it is quite obvious that the teacher helping behavior as a mediator variable stands a significant role in teacher performance.

Zhang & Morris (2013) test the mediator role of an employment outcome and found in their research a relationship that exists between high-performance work systems (HPWS) and organizational performance through the mediating effect of employee outcomes. Their paper is based on a sample of 168 firms of six ownership types and in various business sectors operating in China. The results of the research supported that Organizational performance is positively predicted by HPWS and employee outcomes, while employee outcomes positively mediate the...
relationship between HPWS and organizational performance. This finding highlighted the significance of strategic human resource management practices because adoption of work performance system features individually, might not be effective for achieving the institutional goals.

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Feng Shui in Anthropological Research – Between Perception and Apperception

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Abstract- Feng shui is a traditional Chinese art of designing the environment that incorporates both rational and irrational (mystical) paradigms. In a unified concept, it connects the physical environment, psychology, social relations and the world of the spiritual. In the beginning, the paper analyses the historical and contemporary fengshui anthropological research. It concludes, that feng shui is viewed by most researchers through the perceptual (rational - logical) perspective of an independent external observer, with descriptions ranging from highly critical (a hindering of development or pseudo-natural science) to more lenient (popular religion, cultural geography or cosmology in practice). Only a few people seek to experience feng shui space features personally, through apperception or artistic expression. These apperceptual experiences are supplemented by a two-decade-long case study with the author's participation. It is shown that the practical apperceptions of the energy structure of the physical space can be quite different from fengshui's theoretical starting points. Based on the experience of self-perception, three concepts of generating an energy field in physical space are set up, complementing the feng shui perspective. Feng shui is more than just an example of cultural globalization or a successful historical metaphor because it has the potential to change the existing spatial paradigms.

Keywords- feng shui, anthropology, apperception, self-participation

1. INTRODUCTION AND METHODOLOGY

Feng shui is the traditional Chinese art of environmental design, which is supposed to support the user as much as possible. It is grounded in traditional Chinese philosophy and closely embedded in the Chinese cultural-historical framework. The purpose of this article is to analyse anthropological scientific contributions on feng shui from the point of view of rational analysis (perception) or through the feeling of physical space (apperception). There are two aspects in feng shui that make this traditional art very different from contemporary design practices. These are the concept of the life force qi and the belief that the well-being of the individual is also significantly influenced by the spirits of the deceased family members. In feng shui, both nature and landscape formations and, of course, cities and objects are treated as living beings. The orientation of the building according to the compass direction, the time of construction of the building and the user's birthday should also create a specific pattern of qi. Qi, however, is not the only intangible force in feng shui to co-engineer the quality of life. The spirits of the deceased family, who are supposed to be properly cared for through the cult of ancestral worship, are also playing an important role. Paton sums up the words of the 65th-generation Taiwanese feng shui practitioner He Jinzong when he claims that "feng shui in 50 % depends on the position of the grave of the ancestors, 35 % on the position of the house or workplace concerning the external manifestation of the life force qi and only 15 % on the internal arrangement of the house or workplace concerning the internal flow of the life force qi" (Paton in Mak et al., 2009, 46). From this short outline, it can be established that feng shui operates with concepts that are foreign to modern sciences and which are not easy or even possible to analyse with the current scientific apparatus. It extends both to the realm of rational (when describing the natural phenomena and recommending how we should build dwellings to make the most of the environment) and to the irrational (when defining the energy structure of the landscape or the connection between the world of the living and the dead). It is this connecting of different aspects (physical environment, psychology, social relations and the world of spiritual) into a uniform concept, that is one of fengshui’s essential qualities. To better understand (and experience) it in all its integrity, we should therefore use both the tools of perception and apperception in the research. To determine whether this is true in the way feng shui is researched, anthropological contributions on feng shui are systematically analyzed in the central part of the paper. We wanted to examine whether they are entirely based on rational analysis and logical reasoning, or perhaps also using tools of direct experience and apperception. As an example of the latter, the personal experience of the author is presented.

In the preview, qualitative analysis with document analysis (Bowen, 2009) and desk survey (Juneja, 2020) was used. A systematic and comprehensive review of scientific papers published in professional books, journals, reports and newspapers (Creswell, 2009) was carried out, using the terms 'feng shui' and 'Chinese Geomancy'. The search included the period up to 2019 in the Springer, JSTOR, ProQuest and Google Scholar web bases. All contributions relating to feng shui were included in the first review. From the set of approx. 3,000 hits approx. 300 contributions were selected, based on the criteria of authenticity, credibility and representativeness. They were examined and classified into 7 thematic groups: anthropology, economics, health, modern Chinese scientific research of feng shui, urbanism and architecture, sustainability and evaluation studies.
II. FENG SHUI AND NOTIONS OF PERCEPTION, APPERCEPTION AND ABDUCTION

Feng shui touches on many diverse fields, from art, through social sciences and humanism to science, each with its research instruments and protocols. As we will see below, the researchers' contributions are based primarily on perception and logical reasoning, and few have a direct experience of feng shui physical space. Perception is defined as an awareness of the elements of environment through physical sensation (Merriam, 2018). As a rule, it is an objective (usually instrumentally measurable) perception, which is the result of the functioning of our five senses. In contrast to perception, apperception is in its essence distinctly personal and subjective. Apperception by definition means introspective self-consciousness (Merriam, 2018). It is a personal inner feeling that goes beyond mere external objective sensory perceptions. In feng shui, we can detect two opposite research positions: rational and mystical. The rational position is well known and represents the basis of contemporary scientific thought. The physical space and its users are analysed through the tools of physics, geology, history, architecture, psychology, humanities, etc. The position of the researcher as a neutral observer is required in this role. The posture of the mystical (or apperception) researcher is distinctly personal and subjective. A mystical researcher obtains information through deep internal insights, dreams, hunches, clues or various mystical techniques. The information obtained may seem pointless to the external observer, even absurd and inexplicable with a logically rational scientific apparatus. Bateson (2000, 78, 86) points out that new scientific knowledge can only be found with a combination of a loose and strict way of thinking, regardless of the area of science. For him, this combination of thinking is the most valuable tool of science. It often happens that those who initially create a new structure from a loose way of thinking are different persons than those who afterwards purify this structure. Sometimes centuries pass between the first and second processes. In this context, feng shui is certainly a combination of a loose and strict way of thinking, although, from the position of modern science, we view it primarily as a loose (metaphysical) and less as a strict (rational) mental product. Feng shui can also be seen as the result of the abductive way of thinking. It is a strategy of reasoning which, based on the data provided, offers the most likely explanation of the phenomenon (hypothesis). In the absence of extensive statistics (with which modern science usually operates), the protagonists of feng shui, based on careful observations and in combination with mystical insights, have developed hypotheses (the most likely explanations) for observed phenomena. Pierce (in Paavola, 2004) does not talk about mystical insights when he discusses abduction. He talks about the inner instinct that directs us to choose the most likely hypotheses among the many possible.

III. THE HISTORICAL ANTHROPOLOGICAL APPROACH TO FENG SHUI RESEARCH

Anthropological research into feng shui throughout history is mostly perceptual, i.e. as neutral and objective as possible. As a rule, the personal experience of feng shui is not the subject of researchers. The beginning of western European study of Chinese geomantic can be traced back to the late 19th century when Eitel's book Feng shui or the Rudiments of the Natural Science in China (Eitel, 1873) was published. Eitel, a Protestant missionary in China, first and foremost saw feng shui as an excuse for local authorities and residents, against building new roads and railways, erecting telegraph poles or building new settlements. For Eitel, feng shui is nothing but nature science, a collection of recommendations that are available to us by our instincts and intellects, which the Chinese have wrapped into mystery or turned into black magic. Eitel (2015) notes that the Chinese thinking is similar to ancient Greeks and many Renaissance thinkers, namely that nature is a living organism, where its every part, be it dead or alive, is imbued with spirit or life.

In 1892, the Dutch sinologist De Groot began publishing his monumental work The Religious System of China (DeGroot, 1897), which also features an in-depth analysis of feng shui, based on fieldwork and studies of classical writings. It exposes two origins of feng shui, namely the cult of ancestral worship and the cult of worship of nature as a living being. For De Groot, feng shui is a collection of childish absurdities and sophisticated mysticism, held together by an elaborate system of understanding, which is merely a funny caricature of science (De Groot in Bruun, 2008, 43). De Groot's contemporary Boerschmann spends three years in China and he is more lenient on feng shui in his book Picturesque China: Architecture and Landscape (Boerschmann in Parkes, 2003, 190).

In the postwar period, the interest in anthropological research into feng shui continues. Feng shui is mentioned in the extensive work of Needham Mathematics and the Sciences of the Heavens and Earth (1962). For Needham, feng shui is a pseudoscience that carries a rational grain of understanding the natural laws (Needham in Freedman, 1968). Although Needham doesn't pay much attention to feng shui, it paves the way for more lenient assessments of feng shui with a focus on ecology. The British structural-functionalist Freedman (1968) defines feng shui as a mystical ecology or ritualization of elements of time and space. Feng shui is perceived as a determinant, as the complexity of the functioning of the universe is reduced to the problem of appropriate spatial (and temporal) adaptation of man. Unlike Needham, Freedman characterizes it as a form of Chinese religion which is not related to a single faith, church or priest, but is changing them according to current personal needs (Yang in Bruun, 2008, 87). He also defines feng shui as social relationships stabiliser and, at the same time, a catalyst for community competition. For example, by clearly defining the rules of where a wall can be or how high a house can be, envy and jealousy are also indirectly regulated. And when an accident occurs, it’s the fault of bad feng shui or supernatural forces. In this context, feng shui practitioner is primarily a mediator between the physical and supernatural world (Potter in Bruun, 2008).

March in An appreciation of Chinese Geomancy (1968) offers a fresh and different view of feng shui, which, unlike its predecessors, also derives from apperception. For March, the most important thing is the feeling of space, the interplay of psyche and landscape, and the direct personal experience is of exceptional importance. Feng shui is therefore supposed to enable the individual to feel directly the breath of the landscape, its viability.
and diversity, which stems, among other things, from the interweaving of female yin and male yang forms and the flow of landscape’s qi life currents. A real feng shui location can be experienced as very special, which is difficult to describe in words. The sense of space is crucial for March, although the paper also touches on other aspects of feng shui, which have already been pointed out by predecessors (for example, a motivational aspect that encourages the individual to pull out and succeed despite the uninspiring situation). It also highlights the synchronistic nature of feng shui (associated with Jung’s teachings) where amazing but important coincidences occur in physical space, which do not arise from causation (cause-effect relationship). For March, feng shui is an example of the system through which the will of heaven is exercised.

A few years later, Feuchtwang publishes a much-quoted work An Anthropological Analysis of Chinese Geomancy (Feuchtwang, 1974), in which he conducts a comprehensive analysis of feng shui based on twenty-four traditional texts. In the analytical work, he identifies four roles in which feng shui occurs: classification in feng shui is supposed to reflect the social divisions of society, imagination is expressed in feng shui through symbolism and psychological projections, feng shui can be understood as a divination technique, and the fourth is the role of feng shui as a specific way of detecting reality. For Feuchtwang, feng shui is a way of self-identifying (identification) a person or group (family) through the choice of location, where the location also becomes a centre of personal interests. It highlights the activist role of feng shui, whose basic tool is a metaphor used to explain the fate of an individual (Feuchtwang in Bruun, 2008, 90).

From Chinese anthropologists of this period Yang and his work Religion and Chinese Society (Yang in Bruun, 2008, 90) should be mentioned, which emphasizes the political aspect of the popular Chinese religion and the importance of the cult of ancestral worship. Yang explains that religiously motivated uprisings have always occurred in Chinese society during periods of severe social conflict (e.g. political unrest and oppression), economic decline (e.g. in times of severe hunger) and social disintegration. The pressures have repeatedly resurrected faith in supernatural forces, powers and miracles. In the 1970s and 1980s, there are only a few articles published on anthropological research of feng shui, most likely due to the closure of the People's Republic of China (Watson, 1976). Most of the research is therefore carried outside China's borders: Hong Kong, Taiwan and other Chinese communities of Southeast Asia.

IV. THE MODERN ANTHROPOLOGICAL APPROACH TO FENG SHUI RESEARCH

Even in the last 20 years, interest in the scientific study of feng shui has not faded. The focus, however, remains on the rational analysis of feng shui. For Hwangbo (1999, 191), feng shui is “an ancient architectural theory, /.../ a mixture of art and science.” It highlights the political, religious and philosophical subordination of architecture in Chinese culture, as it has never developed as an independent profession suitable for a Confucian scholar. Therefore, feng shui practitioners took over the role planners and construction coordinators in rural areas where educated people were scarce. Hwangbo’s focus is on the useful aspect of feng shui. The essence of feng shui techniques lies in creating an order in a built environment that mimics the perceived order in life. It points out that many pragmatic elements in feng shui can also be found in modern architecture (e.g. quality sun exposure, protection from wind and other negative impacts). Therefore, the study of feng shui should also be seen not only as a rediscovery of tradition but primarily as a way of creating new paradigms (Hwangbo, 2002).

Paton (2007) focuses on the original concepts of feng shui, as can be drawn from original texts from the period of early, medium and late imperialist China. He is the author of the book Five Classics of Feng shui (Paton, 2013). The first part of the book offers an in-depth overview of classical and contemporary literature of feng shui, the second part is a translation of five classic feng shui texts. It focuses on the scientific nature and historical development of the fengshui school of form. Paton is critical of the modern use of feng shui and its association with new-age content, such as energy cleaning, radiesthesia, holistic health techniques, mysticism, etc., although it also notes that this kind of layering is not only typical of modern times but has always been one of the key features of feng shui (Paton, 2013). He is also critical of the excessive generalisation through which feng shui is easily transmitted to other cultures, without understanding the essence and the basics.

The German sinologist Kubny (2008, 270) points out that the use of the term Chinese metaphysics for traditional Chinese knowledge is inappropriate since the term suggests that the centre of understanding lies behind the explicable world. In the case of feng shui, it is primarily about describing the influences of the power of nature (described by the term sky and earth – tiandi) on a man, who himself is a reflection of this same sky and earth (xiao tiandi). It is, therefore, an attempt to describe the structure of the physical world, but differently from that we are used to in modern science.

One of the most interesting contemporary anthropologists studying feng shui is a Danish researcher Ole Bruun. In Feng Shui and China, Geomantic Divination Between State Orthodoxy and Popular Religion Bruun (2003) explores the social aspect of feng shui through a combined historical-anthropological aspect. It focuses on the period between 1850 and 1990 and summarises the results of several of its field research in the Sichuan and Jiangsu areas carried out in the last ten years before the end of the millennium. He emphasises the importance of ‘in situ’ study of feng shui, always comprehensively taking into account the original cultural-historical environment (Bruun, 2003, 2). Feng shui is a form of Chinese cosmology in practice, where the geomancer strives to discover the ideal cosmological layout (the one that reigns the sky) in a physical environment. For Bruun, traditional feng shui, where there would be only one theory and practice, does not exist at all, except perhaps in academic research (Bruun, 2003, 9). The nature of feng shui is distinctly composite, but there is also a difference between theory and the practical execution of both China’s popular religion and feng shui. For Bruun, “feng shui is a living tradition that has a built-in ability to survive diverse social circumstances, as evidenced by its numerous historical and local modifications (Bruun, 2003, 255)". Like others before him, he highlights the sociopolitical role of feng shui, which, in the last 50 years (and previously in history) acted as a counterbalance of the local population against pressure from China’s ruling elite. Feng shui can be seen as a reflection of the
cosmologically justified resistance of the local population, where the divination of graves is its most religious element (Bruun, 2003, 260). He highlights the dual attitude that the ruling elite had towards the worship of ancestors where, on the one hand, it proclaimed such practices as superstitious and reactionary, and on the other hand, by destroying traditional graves, indirectly recognized the cult of ancestral worship as important. At the same time, the elite always used (at least to some extent) the services of feng shui practitioners at the burials of its family members. Images of irrational from local culture and popular religion always reflect all the important social and political themes of the time (Bruun, 2003, 35). Similarly, for the modern feng shui development in the Western world, it can be argued that it acts as a counterweight to the excessive political, economic and global pressure that seeks to monopolise ways of thinking through the aspect of rationality (Bruun, 2003, 257). In An Introduction to Feng Shui Bruun (2008) upgrades his insights with, among other things, a detailed analysis of the relationship between feng shui and ecology and past and modern feng shui uses. And it is this ability to adapt that has made feng shui so influential throughout Chinese history since every element of everyday life can be linked in feng shui to individual elements of Chinese tradition (Bruun, 2008, 3).

V. OTHER ASPECTS OF ANTHROPOLOGICAL RESEARCH INTO FENG SHUI

Other contemporary anthropological contributions focus on diverse aspects of feng shui, but their analysing concept remains strictly rational. Many contributions try to present feng shui in its historical, philosophical and practical context (e.g. Hwangbo, 2002; Parkes, 2003; Yuan, 2008 or Li, 2014), others focus on specific aspects of feng shui. Emmons (1992) explores how this ancient form of magic has managed to remain in Hong Kong’s rational and business-oriented culture for such a long time, Teiser (1995) analyses the phenomenon from the point of view of popular religion and Montenegro (2003) analyses the comparison between feng shui philosophical platform and Christian world view. Dawson (2006) examines the influences of Eastern thought on the Western way of thinking and concludes that Eastern concepts (e.g. the concept of spiritual growth or depersonalised view of the cosmos), when transferred, adapt to Western thinking modes without actually changing the existing Western paradigm. Other authors also study feng shui in conjunction with other cultures outside its original context (e.g. Braswell- Means, 1990 or Goodall, 2001). Leunga (2010) is interested in the analysis of feng shui in terms of individual belief system, Wan et al. (2012) are exploring how different ways of understanding feng shui affect the likelihood that people will use feng shui.

The cult of ancestral worship represents a special chapter in the anthropological study of feng shui. In addition to historical analyses (e.g. Abraham et al., 2003), researchers are also interested in the manifestation of the phenomenon in modern society. Teather (2001) examines the Hong Kong tradition of cemetery festivals and notes that even today, these festivals still serve their primary purpose, thus consolidating family ties in Hong Kong’s dominant immigrant community. Chen (2016) analyzes the traditional burial ritual in a Chinese village, while Teather (1999) and Yang (2003) discusses a modern form of burial using cremation urns which puts entirely new challenges in front of architects in terms of feng shui. A special research topic is Chinese cemeteries, which were created in other cultural environments (e.g. Peters, 1998 or Lai, 1974 and 1987). For traditionally oriented Chinese, at home or abroad, funeral rituals remain an important part of collective identity.

VI. FROM REJECTING CRITICISM TO MORE LENIENT ASSESSMENTS

All the contributions presented above are made from the standpoint of an independent external observer, i.e. objectively and rationally. Nevertheless, the changing attitude towards feng shui through history is primarily due to changes in Western society and not due to changes in feng shui practice. In the 19th century, initial curiosity was followed by a very dismissive reaction, in which feng shui was treated primarily from a perspective of superstition, irrationality and reactionism that inhibits development. We can find labels of feng shui as "funny caricatures of science" or "the mess of absurdity (De Groot, 1897, 938)" or "perverse use of physical and meteorological knowledge (Sarton in March 1968)". There is an element of racism in which the Chinese way of thinking is treated as inferior, and the Chinese as stubborn and resisting change. These critics come from an imperialist society that focuses on economic exploitation and is imbued with enlightenment philosophy and the principles of Western science. In the first half of the 20th century, the criticism becomes more compassionate and less dismissive, with a sincere desire for an in-depth understanding of philosophical basics. Peter (in Mills, 1999, 73) defines feng shui as "a historical remanence that points to human initial stages of truth-seeking." For Needham (in Mills, 1999, 73) feng shui is a pseudo-science. For modernists, feng shui is still irrational, unscientific and reactionary, but no longer threatening. It is perceived as an interesting historical or cultural phenomenon that cannot be easily classified into familiar categories. It is treated from a perspective of mythology, folklore, popular religion or cultural geography. Definitions of feng shui become more neutral, such as "popular religion (Freedman, 1968, 13)" or "a belief system that shows where and how to erect a grave or house so that future prosperity is guaranteed (Eitel in Froehling, 2015, 7)". March (in Mills, 1999) is one of the authors, that talk about the deep sensing of the landscape through "connecting the psyche and the landscape". He is the only of the presented authors who gives a personal experience of what feng shui is about.

"In the right location /.../ the light is magical. How magical? It can be understood intuitively, but its meaning is difficult to convey in words. The hills are beautiful, the waters are good, the sun is pleasant, the breeze is mild and the sky is illuminated by a special light: another world. There's peace in the confusion, there's a festive feeling in peace. When you get into the presence of space, the eyes open, if a man sits or lies down, the heart fills with joy. This is where the breath gathers and the essence focuses. The light shines from the middle, and the magic extends to all sides. /.../ Try to understand this! It's hard to put into words." (March, 1968, 259)

The lenient definitions of feng shui continue over the past two decades. Hwangbo (1999, 191) defines it as ancient architectural
theory and Bruun (2003, 2) as a realisation of Chinese cosmology in practice.

VII. APPERCEPTION AND ARTISTIC EXPLORATION OF FENG SHUI

Only March shifts from the role of a researcher using perception to the role of using apperception, the one who is personally experiencing feng shui in physical space. This form of personal participation and use of common sense is often used as a scientifically appropriate method in the research process, especially in social psychology and sociology. Hamel (1997) presents Tourain's method of social intervention, where actors of a social movement (e.g., students, women, environmentalists and workers) are active participants in the design of the theoretical framework of their social movement using their experience, self-analysis and the help of professional sociologists. Common sense psychology is also known by the terms naïve psychology, ethnopsychology or indigenous psychology (Kelley, 1992). It is characterized by the use of everyday language to describe various psychological phenomena (see e.g. Heider or Smedslund (both in Kelly, 1992). Feng shui is largely the product of a common-sense way of thinking.

Other identified contributions describing the experience of feng shui through apperception belong exclusively to the field of art. Dong (2017) in Integrating Feng Shui Concepts into Painting Creation shows how he uses feng shui principles in painting (e.g. qi concept, the contrast of yin and yang, five elemental phases). Before he starts to paint, he focuses and collects qi in his body and then expresses it through brush strokes and the choice of colours. He describes the experience as very emotional, explosive, spiritual and out-of-body. In his paintings, the worlds of East and West are brought together, and Dong sees his concept of painting as a structure that can be used in both painting, sculpture or any other art. His artwork combines the philosophical essence of feng shui with the expressive means of modern Western culture.

China Blue is a conceptual artist who explores the links between art and technology and between architecture and culture. He is looking for new typologies of expression, and one such artistic matrix is feng shui (Blue, 2003). The work uses a commercial feng shui concept, in which certain areas in the room relate to areas of the user's life, which he upgrades using modern technology. The qi concept is used in a way that the energy of a person (e.g. movement in a room) is 'translated' through sensors into music sound or light. In this way, it creates a sequence of events triggered by the presence or energy of the person entering the room. Laura's Jobbering Jobberwocky light is an artistic object, whose motion sensors trigger the play of the Jobberwocky song. With China Blue (unlike Dong), it is not about a personal experience of feng shui, but about using feng shui as a structural matrix for artwork. Feng shui also appears as a cultural backdrop in novels (see e.g. Hsu, 2006 or Vittachi, 2009).

VIII. CASE STUDY THROUGH SELF-PARTICIPATIVE APPERCEPTION

The examples of Dong and March show that the concept of life force qi can be regarded not only as a metaphysical concept but as a physical phenomenon that can be experienced or observed through its effects. This view is also supported by the results of scientific research confirming the existence of external qi (e.g. Lu, 1997) and showing that qi can influence substances such as water, DNA or atomic nuclei without physical contact (e.g. Yan, 2018). Qi has properties of matter and energy, and due to the current limitedness of existing experimental methods, many of its properties can’t be examined in depth experimentally.

I have scientifically researched feng shui for the past 20 years (Kryžanowski, 2012a and 2019) and along with that also through self-participative apperception. The basic training to detect external and internal qi (also known in the Indian tradition as prana) was achieved through the practical study of radieesthesia, bio-energy healing, reiki, regular daily practice of meditation and encounters with highly spiritually developed persons. I also designed feng shui projects (see e.g. concept of a vital house in Kryžanowski, 2012a) and performed feng shui studies for clients.

Based on my own experience I estimate that the ability to detect or feel qi is primarily the result of choosing a proper technique and being disciplined in doing the exercises. In the same non-mystic way as acquiring any other competence. The flow of life force qi, which I perceive in my body, feels like a stream of energy with properties of water, wind and electricity that can also cause an emotional sensation. The quality and intensity of the current can vary greatly, and I can generate the current myself through the use of willpower and focus (in a similar way as Dong describes it) or I can only observe it. In this case, I do not generate myself, my role is the role of the observer. Some perceptions are barely noticeable others are strong and intense. Over the years, I have developed an evaluation system for the qi currents that I do not generate myself.

Based on the intensive multidisciplinary research of feng shui and my personal perceptive experience of the energy structure of the physical space, I conclude that my experience does not confirm what feng shui theory teaches about qi patterns in physical space. Especially those of the feng shui school of compass, where certain segments of the room are expected to have a favourable or non-favourable impact due to their specific compass orientation or time component. Similarly, I never detected the flow of qi in open landscape or inside an apartment in the way that the school of form teaches. Of course, this does not necessarily mean that such currents do not exist. I may be simply insensitive to the qi flow as explained by feng shui. For me, the life potential of physical space is more like a field with different qualities, rather than an empty physical space in which currents flow. At the same time, I have some intense experience, through which I know that the physical space can be (very much) alive, but I can’t connect them to the fengshui teachings.

One of these experiences comes from Mithra’s Shrine in Ptuj (Slovenia). When I entered the hall, I detected a brutally intense stream of energy in the middle of the room, which in its character was very primordial and raw and, in the shape of a pillar with a diameter of about two meters lifting from the ground vertically upwards. The current was so strong that I would not be able to sit on the floor in its immediate vicinity, even if it wanted to. I quickly left the hall. The current was detected by a couple of colleagues through their bodily sensations or by radieesthesia instruments. It felt like my body was on fire and it could self-ignite. My impression was that this was an energy source that was
reviving this part of the landscape and that the shrine was erected mainly to prevent people from wandering too close. Years later, I returned to that same shrine, but the current was gone or was not active. It is worth noting that the feng shui school of form talks about xue points, in which the earth’s energy qi, comes out on the surface of the landscape. Other intense perceptions of energy flows or fields that I experienced are related to physical spaces that have a spiritual (or religious) nature. Although I was raised in an atheist belief, I occasionally visited the Catholic church rites for family reasons. During one of these rituals, an extremely strong energy current poured from the ceiling of the church down onto the public. I estimate that the priest who led the ceremony did not sense it. I got the impression that religious rituals (as a rule) were designed in a way that invokes spiritual energy flow, which in religious terminology is called a blessing. But it doesn’t always happen. In similar Catholic and Hindu rituals which I attended this was not the case. On the other hand, I have the experience of strong energy fields around the altars in several Indian temples, regardless of the presence of a ceremony. I also have years of repetitive consistent experience of a clear perception of a strong energy-spiritual field created by highly spiritually developed creatures (such as Satya Sai Baba or Stephen Turoff). All those experiences made me wonder, whether the vitality of physical space is the result of special physical factors (like e.g. feng shui) or if it is the result of the people and processes that occur in the physical space.

Based on the apperception experience so far, I estimate that energy fields in physical space are generated in three ways. Firstly, the fields may be the result of a specific location of the physical space (e.g. the aforementioned energy spring at the Mithra’s shrine in Ptuj) or the special arrangement of physical space (e.g. vitality, which according to Alexander (2002a, 2002b, 2004 and 2005) comes from the geometric structure). Both aspects are also part of fengshui teachings. Fields can also be generated artificially in physical space, due to the so-called bio-generators. I would say that in this way the energy fields in the tunnels of the Bosnian pyramids (see, for example, Osmanagich, 2014) are created. Secondly, fields are generated in a particular space permanently due to repetitive processes or rituals (for example, energy fields around altars in temples and ashrams in India) or a unique special event (for example, energy fields generated in a place where a highly spiritually developed person has entered a mahasamadhi (conscious self-execution or planned exit of the soul from the body). Energy fields can also be generated in space temporarily (for example, an energy field created during Turoff’s light circle meditation). Thirdly, energy fields are generated around a highly spiritually developed person and are not bound to a specific location. It is worth noting that, in my experience, an energy field generated by a highly spiritually developed person has a completely different quality than the energy field generated technically (e.g. in the tunnels of the Bosnian pyramids) or as a result of a specific location (e.g. the energy vortex in the Mithra’s shrine). The energy field of a highly developed spiritual person supports the rise of an individual’s level of awareness and allows entry into the state of spiritual connection of everything with everything (a condition described in my experience by the religious term bliss). The technically generated field doesn’t have that ability. At the beginning of the vitality research, I prioritised the design (probably due to the study of architecture and feng shui), but today, based on the experience gathered, I estimate that the design is distinctly secondary and that the vitality of the physical space is crucially influenced by the people and processes using the physical space.

**IX. CONCLUSION**

Fengshui’s nature is distinctly dual, so we need to use both the tools of perception and apperception to understand it. It is because of its dual nature that Paton (2007, 438) describes it as one of the attempts to humanize science. In the West, the feeling is, that the magic and power of the individual has disappeared from life, because large scientific conglomerates control science through dry statistics. There is a need for modern humanistic scientific systems which would be able to integrate both the rational and emotional aspects. It is the mystical element in feng shui that is probably most credited to its popularity in the modern Western world. The main task of any religion is to offer basic answers to the questions of who we are, where we come from and where we are headed. In the alienation and spiritual emptiness of the post-industrial and postmodern society of the Western developed world, a great need for the creation of personal, social and spiritual meaning is created, which the Christian and Islamic historical metaphors can no longer satisfy. Therefore, new-age movements (including feng shui) appear as a substitute for all individuals who are left dissatisfied by modern scientific, positivist and rational world view (see e.g. MacDonald, 1995). In this context, modern feng shui is a historical metaphor that draws on historical tradition but transforms it to meet modern needs, by both East and West.

Feng shui is also a great example of cultural globalization. Of course, Westerners are not interested in feng shui as a culture associated with the worship of ancestors and the art of proper placement of graves or tombs. They regard it exclusively as the art of designing dwellings for the living (with an emphasis on the decorative aspect), as a technique of empowering the user and as a means of individualizing space. In this, the feeling of space (individual apperception) plays an important role.

Feng shui is also closely related to the concept of transgression due to its dual nature. Transgression usually refers to phenomena that transcend the boundaries of the ordinary, which represent a move away from social or moral conventions (Kos, 2012). And feng shui is, at present, beyond the transgressional boundaries of modern science, as it is generally classified as pseudoscience. We know from history that science in the early stages included various cognitive concepts: mathematics, metaphysics, hermeneutics and empirical testing. Since the Enlightenment era, science has evolved into a logical scientific system based on the methodical processing of empirical data and reproduction of the results obtained. Modern science is reluctant to transgressive thinking. Loosening the empirical point of view can lead to contact with the irrational, which is unacceptable to the prevailing scientific paradigm. Although creativity and innovation are embedded in the fundamental concept of science, they can only happen in the field of established system logic. In the context of transgression, feng shui can be seen as a system that encourages us to rethink the established perceptions of physical space and to transcend the established norms, principles and mechanisms of our action in this physical space. In this sense, feng shui can help us create new, more comprehensive spatial paradigms.
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Participation of Fathers in the prevention of Teenage Pregnancy: A case study on fathers & daughters who are teen mothers in Botswana.

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Abstract- Research on father-daughter relationship, active fathering and open communication on sexuality issues show that, participation of fathers in active caregiving is critical for the sexual development of children especially girls. This study explored father-daughter relationship benefits in relation with the prevention of teenage pregnancy. Eight in-depth one-on-one interviews were conducted with teenage mothers and two groups of focus groups of discussions were conducted with male caregivers to the teenage mothers in Mochudi. Several themes emerged; contemporary fathers are keen to actively participate in caregiving; mothers are still perceived to be the right people to educate children on sexuality issue. Fathers’ involvement in their children’s early stage of live is fundamental in having safe intimate and respectful relationship with the opposite sex. The study concludes that active participation of fathers in caring for their children especially daughters can translate into a protective layer that reduces daughter’s vulnerability.

Index Terms: father-daughter relationship, participation, teenage mothers, teenage pregnancy.

I. INTRODUCTION

Botswana is currently faced with escalating rates of teenage pregnancy. This gives a picture that teenagers or adolescents continue to engage in early sexual activities under different circumstances. As a result, adolescent girls are exposed to many health challenges including sexually transmitted disease, HIV and cervical cancer among others (Republic of Botswana, 2016). In addition, this leads to girls dropping out of school leading to poor quality of life. The decline on the quality of life for children and high levels of vulnerability especially of girls has been linked to lack of positive male role models. In situations where fathers (biological and or social father) have warm and loving relationship and open communication on issues of sexuality with their children, children tend to have safe intimate and respectful relationships with the opposite sex (Maundeni, 2000, Beardshaw, 2006, Bowling, Werner-Wilson, 2009). Literature indicates that majority of children engaging in early sexual activities are found to be from absent father households (Mendle, et al, 2010). Botswana has been found to have an alarming rate of children who are raised without their fathers, worse, not knowing and having any meaningful relationship with their biological fathers (Maundeni & Nnyepi, 2012). The United Nations International Children’s Emergency Fund, 2012 report revealed that in Botswana over two-thirds of children aged 7-17 years do not live with their biological fathers. Considering that many behavioral change strategies have been implemented in Botswana to curve teenage pregnancy, this study explored the participation of fathers in sexuality education and prevention of teenage pregnancy in Mochudi. To establish the link between the level of fathers’ participation in sexuality education and the prevention of teenage pregnancy, the following questions were addressed; to what extent do fathers discuss sexuality topics with their daughters? What are the benefits of participation of fathers in prevention of teenage pregnancy?

Background

The traditional and cultural expectations of the male parent are woven together into the historical expectations of the definition and role of the father in holistic family life including raising children. Historically, the meaning of the word “father” was primarily socially constructed with societal expectations for fathers’ role. From observations growing up, Fathers worked very hard to provide material needs for their families. They were expected to be disciplinarians who demanded respect and obedience from their children and submission from their wives. Generally, fathers invested little or gave no attention in building close, safe, intimate open and honest relationship with their children. The mother was expected to empower and teach the female children on how to be a woman while the father was responsible for the boy child.

For instance, in Kenya, traditionally fathers encouraged their sons to learn about successful manhood from them and other male elders in the community. According to Lasser, Fite & Wadende, (2011) “Among the Kikuyu, the Kenyan father socializes the son in his craft or role in the community and consequently fathers have a more direct influence on the lives of their sons than daughters”, (p. 51). This trend was also evident in most Botswana cultures such as the Xhosa in Bikwe, Manyana and Bakgatla ba ga Kgafela in Mochudi, through the traditional schools (initiation schools) boys and girls were separately grouped and taken for a camp and taught how to be a responsible man and a woman in a family and society. During those days, initiation schools were the pre-requisite to adulthood and marriage. For the boys, this went as further as circumcision, a permanent sign of manhood or a “real man” (Gungqisa, 2010). The mother is still expected today to empower and support her daughter into adulthood, motherhood and marriage. In Botswana, when a girl falls pregnant for example, women are expected to be at the center of taking care of the expectant mother, including engaging her to find out who impregnated her and report to the uncles so that they can report the pregnancy to the men’s parents. Most men do not feel nor believe that it is their role to socialize.
their daughters and empower them on issues of sexuality. In many ways, this could explain why some men do not find anything wrong with being involved in intergenerational sex with young girls the same age as their biological daughters.

The family structure in Botswana has changed considerably since independence in 1966. The traditional nuclear and or extended family structures have been gradually replaced to a significant extend, by single parent families. Gaesie, (2002) described the new family structure as the ‘zero-couple’ or single-parent family or household type which constitutes about 70 per cent of the households in Botswana and 90 per cent of these are headed by females (p.1). These alarming numbers of female headed household statistics calls for research in understanding the role and benefits of a father in raising children. This includes the biological (residing and non-residing) and social fathers. Many social problems experienced by youth today are linked to the generational gap that exists between parents and their children which sometimes results in lack of parental guidance and communication on issues of life in general and of sexuality in particular. In addition, young people’s vulnerability has increased mostly because of risky behavior such as engaging in early sexual activities with older men, drugs and alcohol abuse and dropping out of school, all these factors put together contribute to the circle of sexual abuse and poverty (Botswana Daily News, 2014).

The social and gender research field has for a long time experienced a gap in the investigation of the significant role of the father in raising children. Greene & Biddlecom (1997) observed that in turn, there is a depiction of fatherhood oppositional to and in conflict a “deficit” model of fatherhood (p.36). Viewed from such as vantage point men are either providers, disciplinarians, absent, and irresponsible fathers (Fox, 1999). However, just recently there has been a turn over to study fatherhood in a positive light. A new kind of father is emerging. This father still plays a major breadwinner role but is also more involved in domestic tasks and caring for children.

Methods

The participation of fathers in prevention of teenage pregnancy in Mochudi was investigated using qualitative research method. The method facilitated the researcher’s flow in capturing and understanding authenticity of the human stories in their raw status and by so doing “achieving an accurate accountability of the meaning informants attributed to those events that participants would agree is accurate” (Holmes- Walker, 2010, p. 37). In addition, the chosen design has been described to be appropriate when the subject of the study is relatively new and unstudied (Rubin & Babbie, 2008, Holmes- Walker, 2010). Throughout literature review, it is evident that many studies have been done on teenage pregnancy but very few of them explored the phenomenon with a focus on the father’s involvement in issues of sexuality education and healthy relations.

Two data collection methods were used for the investigation of the study, these were: the in-depth semi structured one on one interviews and the focused group discussions. The selected methods are aligned with the qualitative approach described above and Holmes- Walker’s (2010) explains that “qualitative interviewing begins from the assumption that it is possible to investigate elements of the world by asking people to talk, and construct knowledge by listening to and interpreting what they say and how they say it ” (p.37).

Sampling

The determined population for the study was in two categories. Group one was the out of school teenage mothers who were pregnant or had been pregnant and had father figures in their lives, not necessarily residing with them, however, it was necessary that participants had an ongoing relationship. The father may be the biological, legal guardian, or social father (teacher, uncle, brother or pastor). The reason that motivated the researchers to include social fathers is the fact that collective fatherhood is still evident in Botswana. Teachers and Pastors for example, play a significant role in grooming adolescents. In addition, with the high numbers to single parent households in Botswana, we find elder brothers and uncles taking roles in collective fatherhood in their extended families. Literature indicates several benefits of collective fatherhood even though it is viewed to be fading. Lesejane (2006) observed that, the advantages of collective fatherhood also not only enhanced the economic status of the family but also the child’s social capital. Social capital in this context means the number to interactions the child is exposed to within the family. These interactions contribute to the child’s emotional, cognitive, education and social development which the current nuclear family structures mostly female headed fail to provide to children. In particular the girl child seems to be mostly disadvantaged compared to the boy child because their vulnerability to sexual exploitation and early sexual activities is higher to that of their male counterpart. A total number of 15 teenage mothers and 15 fathers participated in the study.

Purposive sampling was used to recruit teenage mothers based on the common particular characteristics which are of interest in the study. For instance: the selected female informants must had been pregnant or were pregnant at teenage age (13- 19) years and have a relationship with their fathers. On the other hand, male informants were recruited through snowballing sampling. The researcher was introduced to the fathers by the teenage mothers after interview and this technique enabled the researcher to build rapport in preparation of the father’s focus group discussions with other fathers with similar attributes (caregivers for teenage mothers).

The data collected from thirty informants has been categorized into emerging theme and discussed according to research questions. The demographic section of the survey indicated that interviewed teenage mothers ranged between ages of 15- 18 by the time they became pregnant while the fathers of their children ranged between 20 – 35 years of age. All fifteen teenage mothers interviewed dropped out of school due to pregnancy, 25% of them reported to have been impregnated by their male partners who were in tertiary level, 37.5% of the male partners were unemployed while the remaining 37.5% (25- 30+ years) were employed. Only 25% of the teenage mothers managed to continue with their education in local private training institutions pursuing secretariat and business administration courses. The remaining 75% of these teenage mothers did not complete high school at the time of the research.

The second group of informants (fathers; both biological and social fathers) ranged from the ages 38 to 53 years of which...
62.5% of them raised their biological daughters while 37.5% were social fathers (uncles and brothers).

**Findings**

To what extent do fathers discuss sexuality issue with their daughters

Interviews with teenage mothers and their fathers revealed that generally fathers do not discuss sexuality issues. Firstly, 37.5% of teenage mothers reported that they do not have a close relationship that could allow open discussions with their male parent except that of being blood related. 60% reported having a close relationship with their fathers but advanced that it is not easy to discuss sexualities with them. This is what one of the teenage mothers said: Teen Mother 003

“Yes we do have a relationship. It is open and free because we openly talk about life. For example, we mostly talk about employment and our needs especially taking care of my children”.

Similarly, fathers noted their upbringing and culture as a barrier to easy and open communication of sexuality issues with daughters. For example, this is what one of the fathers said:

“A Motswana man has been socialized not to discuss sexuality topics with the female child. Even the educated men are unable to talk to their daughters about sexuality issues, rather women are better placed to do that. For instead, when my daughter started her menstrual periods, I had to ask my neighbour to advise her….What can I say as a man? Truly what we know is to discipline so instead men use anger and threats as strategies to instil discipline, and unfortunately it is not working. As a result, their children view them as “lions.”

Father 1’s response shows that fathers tend to relate with their daughters as disciplinarians only hence the failure to be at ease with sexuality issues. This is linked with lack of appropriate vocabulary and communication skills largely to do with culture. In addition, fathers stated that they were not taught or socialized to relate with female children to a level of talking about sexuality highlighting the fear of family suspicions of sexual abuse. The same has been observed by Werner-Wilson & Fitzharris (2009) who observed that “parents seem reluctant to discuss sexuality with their adolescent children because of a lack of knowledge and understanding of human sexuality” (p.49).Moreover, traditionally sexuality issues are regarded as secrecy and sex as “dijo tsa bagolo -the grown- ups food” that they cannot be openly discussed, (Ntswarang & Malinga, 2011).

However, some fathers shared that once in a while they caution their daughters on sexuality issues whenever they see the need (when they notice a behaviour that the daughter may be starting to date). This is what some of the fathers shared:

“I talked to my younger sister mostly about the current calibre of boys. Most importantly I talked about strategies men use to influence girls to date them not necessarily because they love them but because they want to have sex which might result in unplanned pregnancy. They are likely to impregnate a girl and leave them. For example, some men normally use money or expensive gifts like cellphones to entice girls.”

This is in consistency with the findings by Collins, Angera and Latty (2008) that as a result of lack of confidence by both fathers and daughters in discussing sexuality issues, fathers were reported to have been unable to actively participate in prevention of teenage pregnancy. Daughters responses resonated with their fathers’ as they reported that it is not comfortable to discuss certain issues with parents especially fathers. Some daughters also reported that they felt their fathers were probably not the best people to talk to about sexuality issues. In their words, they said;

Teen Mother 004

“Aah! How do I just talk sex with my father or even my mother! We do have a relationship but it is not close or open where I can easily talk about issues of sexuality. It is more of providing material needs such as food and toiletry.”

Interestingly, some fathers believed that they do not necessarily have to say anything rather their presence at home, not necessarily engaging with their daughters, communicates accepted and unaccepted behaviour. 50% of fathers believed that their daughters mostly have their free will to do what they like and misbehave in their absence. This suggests that mothers are accommodative of unacceptable behaviour and not instilling discipline with the same efforts fathers do. The following utterances were made by one of the fathers;

“I raised my younger sister and during the time I was staying with them there was no sign that they are dating. The time I moved from home and they were left with my mother, their behaviour was out of hand. That shows that they respected me. My presence meant something to them”.

Acknowledging that there is a gap that needs to be bridged by father’s active involvement in raising daughters and in sexuality education, fathers emphasized that it is critical for male parents to build close, safe, loving trusting relationship with their daughters from birth. This would be a firm foundation throughout stages of life would be much easy and meaningful compared to when it starts at the most vulnerable stage of teenage- hood. Teenage-hood is also a time when adolescents are battling with issues of self-identity, body image, low self-esteem; psychological transition and pressure for sense of belong among others. In addition, this is also a period when girls need attention and open communication on issues of relationship with the opposite sex, and confirmation that she is smart, beautiful and she is trusted to make good decisions in life.

“A man who raises a child with love never becomes dangerous. Men who “stay” (without health relations) and not leave with their children always behave like lions, who cannot even play with their children or express affection, are very dangerous to take care of children. I think they need counselling because most of them are full of anger. They need to be empowered to be caregivers”.

The teenage mothers concurred with the father’s utterance as they described the kind of relationship they would like to have with their male parents. Most importantly, girls wanted emotional support from their fathers. Below are the teenage mother’s wish lists for their fathers;

Teen Mother 004

“I wish my father and I had a loving relationship where I will be told how much I am loved and appreciated. I believe if I had an opportunity to enjoy my father’s love by being hugged, kissed, looked in my eyes and told that I am beautiful and intelligent, I would not have searched for attention outside home, engaged in sexual activities and consequently become pregnant at the age of
fifteen. I felt safe in my boyfriend’s hand and he was the first man to kiss me and called me sunshine”.

The benefits of participation of fathers in prevention of teenage pregnancy

Building a relationship from early ages is the foundation

Fathers expressed that their active participation in raising children helps build a strong foundation of a loving, respectful, safe and close relationship. Fathers further stated that such relationship can definitely reduce the girls’ vulnerability to start engaging in early sexual activities and reduce cases of teenage pregnancy. They strongly believed that there are special skills and knowledge that can only be imparted by a father in a girl’s life. Through the informants’ experiences and observations, daughters who grew up close to their fathers are more self-disciplined compared to those who do not have father figures. Moreover, teenage mothers also believed that their fathers play a critical role in confidently making informed life decisions including their sexual behaviour especially delaying sexual activities. It seems most informants wanted to hear fathers reinforcing their daughters’ worth. They believed that close relationship with their fathers would teach them to develop safe relationships with males later in life. Bowling and Werner-Wilson (2009) results are in coherence with the current observations as the study revealed that daughters felt that fathers should empower their girls to attain independence and confidence “masculine traits” while nurturing feminine traits as well. “In particular fathers seem to significantly influence independence and autonomy in daughters and this support seemed to promote higher self-esteem and confidence.” (p.17).

Responses from teenage mothers indicate that they need their fathers to engage in conversation with them rather than giving orders or instilling fear on them. Teenage mothers want to seek understanding on men and women’s relationship. Below are teenage mothers’ voices in seeking knowledge and understanding:

Teen Mother 002
“I want to know why men like to make girls pregnant and never care to know how the pregnancy or even the child is after birth and also never make an effort to support the new born baby”?

Teen Mother 003
“Why men fail to understand and accept that women are not always ready to have sex with them anytime they feel like. Why men mostly start abusing their partners verbally and accuse of having other partners even if they know the woman is faithful.”

A father’s relation to her daughter and mothers has been described as a “blue print or a reference point” in the future when she reaches teenage stage and start to develop interest in the opposite sex. According to Bowling and Werner-Wilson (2009) reported parent modelling of love and respect as one of the critical issues that influenced informants’ beliefs that respect and commitment are prerequisite for engaging in a sexual relationship. Her vulnerability will decline as she will be armed with knowledge, images of a healthy relationship, and language of love and also comfortable in her skin because she has heard it, felt it and seen it freely given to her by her father. Below are observations from fathers:

“My experience is that love is very important in raising children. Father’s love to her daughter teaches her how she must relate to her male counterparts and signs of a healthy relationship. That also applies to how the father relates to the child’s mother. Their behaviour is a reference point for the girl child in the future when she starts dating. She will look for the partner with the same behaviour and attitude like her father. In case someone does or say something contrary to what she has been exposed to at home, she will easily sense danger and apply her coping skills. As such, daughters see their fathers as their protectors and can easily share with them if they are not happy with how she was treated by any boy/man and women. Sometimes she will particularly request her male caregiver to collect her academic report because there is someone bulling her at school and wants her father to address that person. That on its own helps to build a child’s confidence not to fear anything or anyone because she is sure about her protector and always gets a balanced encouragement and motivation from both the mother and father compared to a child raised by a single mother or a distant father.”

Fathers were also given an opportunity to give messages for their daughters. Data reveals that fathers are capable of effectively and meaningfully discussing sexuality topic with their daughters if and when given safe spaces to do so. An outstanding feature of the messages was the presence of faith and use of the Bible as a reference point addressing sexual values. Furthermore, the responses also highlighted the authoritative attitude of parents in communicating with their daughters. On the other hand, daughter expects their fathers to engage in a conversation rather than give them warning on issues of relationship, sex and pregnancy.

Conclusion

The study revealed that contemporary fathers are keen to actively participate in sexuality education specifically with their daughters as a strategy to reduce teenage pregnancy rates. The study revealed very minimal discussions between fathers and daughters on sexuality matters that could help mould sexual behaviours and ultimately curbing pregnancy. The main barrier articulated by both fathers and daughters is communication skills due to cultural stereotypes as issues of sexuality are regarded as private, rendering it challenging to be a topic of discussion amongst young and olds. The observations from fathers are in agreement with life course theory that “to understand contemporary fathering is to pay close attention to personal and social change in men’s lives, hence it makes sense to mark fathering by noting transitions, growth or decline” (Roy, 2014, p. 319).

In addition, fathers stated that in the current changing society where physical, verbally and sexually abuse of girls and women in general is on the rise and the alarming rate of single mother families, they strongly feel that they have to rise up and take their place to protect and empower the girls. Fathers acknowledged their inadequacy in communicating with their daughters citing that they need to firstly be empowered to break the socialization and cultural barriers that formed the bases of traditional manhood.

The study concludes that fathers have a critical role as the “daughter’s first love” to build her social skills, appropriate and inappropriate relations with the opposite sex, love languages and self-respect among all. Girls wish to feel, hear and witness love from their fathers. The results strongly reveal that daughters believed that sharing values about sex with their fathers will make a difference in their sexual development and behaviour.
Furthermore, research clearly articulated that girls value attention and affection above status and possession from their fathers.

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Camera Image Based Method of Real Time Gaze Detection and Interaction

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Abstract- There are many possible applications for tracking the gaze of a person. For example, it can be used to analyze which areas of a website are attracting the most attention in order to optimize its layout. Another possible application is creating a barrier-free computer interaction for people with a limited ability to move. Some companies are specialized in gaze tracking technologies and offer different solutions. The downside of those solutions is, that they require special hardware and therefore are not affordable for everyone. This paper presents a method using only one camera for gaze tracking. It is based completely on free accessible software and only needs an ordinary camera, which is integrated into almost every laptop or can be connected as external hardware. The target is to proof that it is possible to obtain a usable gaze interaction while using simple hardware and algorithms. By this method it is possible to achieve resolutions of up to 17 columns and 15 rows, which is enough for special applications.

Index Terms- computer vision, gaze detection, gaze interaction, gaze tracking, machine learning

I. INTRODUCTION

There are many possible applications for tracking the gaze of a person. These can be divided into passive applications, which only gather information and do not interfere with the user experience, and active applications, where the user can utilize them as an input device. Passive applications are often used for marketing reasons, for example to investigate which areas of a website or product attract the most attention of the user and use this information to design a better layout. But safety related applications exist as well, for example in the automotive sector, where eye detection is used to ensure that the driver is focused on driving, as described in [1] and [2]. Active applications on the other hand aim to create a better user experience by providing an alternative or additional input device for the user. The range varies from making a computer usable for physically disabled persons, e.g. for text input as described in [3], over increasing productivity in different scenarios ([4], [5], [6], [7], [8]) up to using it to control the camera in videogames as described in [9]. A software used to emulate mouse input from gaze tracking input is presented in [10]. Investigations on how gaze interaction performs as input method against the commonly used computer mouse are shown in [11]. Different companies, for example Tobii, have specialized themselves on this topic and provide different gaze tracking solutions based on hardware specifically developed for this purpose, where different techniques are used to receive high accuracy. Most of them are camera based, whereas other approaches also exist, such as contact lenses with integrated inductors, which create a magnetic field that can be measured. An overview of often used techniques is collocated in [12]. Camera based solutions tend to use setups with multiple cameras to obtain a depth of information and compensate distortion caused by viewing angles and for other reasons. When it comes to detecting pupils, infrared lighting is often utilized to detect pupils in the first step and to determine their gaze direction in the second step. The reason for this is that a certain, very small area of the pupil reflects infrared lighting and therefore can be easily detected by a camera. The location of this area relatively to the whole pupil can be used to precisely determine the gaze direction. Another approach is presented in [13], where several light sources at different locations are used along with raytracing to determine the gaze direction. Those solutions deliver a high quality, but the downside is the usage of specialized hardware, that has to be purchased and may not be affordable for everyone. The motivation for this work is to proof that it is possible to create a free gaze tracking solution that is only realized in software and works with ordinary webcams in the first step. Furthermore, the accuracy of the developed software will be tested.

II. APPROACH

The main objective is to determine the location on the computer screen where the user is looking at, in the following referred to as target location. Basically, two kinds of information are needed, the first one is the location of the eyes relatively to the computer screen and the second one is the gaze direction.

A best-case scenario would be if this information would be known exactly. In this case the gaze direction vectors could easily be projected onto the computer screen and after that the point of intersection could be determined, which would be the target location.

The reality is a lot more difficult. The only information available is the two-dimensional frontal image of the user’s face, which is captured by a camera that ideally is in a fixed location relatively to the computer screen. Otherwise there would be additional insecurities to deal with. From that image
the eye locations have to be determined as well as the gaze direction. A value that cannot directly be derived from that image is the location of the screen or its size, the easiest approach to tackle that problem is to calibrate the system, which will be described in section IV. The approach to achieving the main goal can be divided into two main tasks. The first task is the detection and localization of the relevant facial structures that are needed and will be described in section III. The second task is to determine the target location based on the information received from the first task and will be described in section IV.

III. DETECTION OF EYES AND PUPILS

As described previously, the first task is to gain the relevant facial structures and their locations from the image received by the camera. One structure needed is the location of the eye within the image. The gaze direction cannot be gained directly. But it can be derived indirectly from the location of the pupil. As the pupil is the part of the eye, which absorbs the light, it is directed to the location the person is looking at. Therefore, you can determine the gaze direction indirectly by determining the location of the center of the pupil relatively to the location of the eye. In conclusion, the information that has to be derived from the image are the locations of the eyes and pupils.

*Dlib* is a cross-platform software library written in C++ that offers the needed algorithms and is used to detect and locate the eyes, which is done in three steps, which are the following:

1. Detect and locate the face in the image
2. Detect and locate facial key points
3. Derive the eye locations from the facial key points

These algorithms are based on machine learning, where large datasets, e.g. the one described in [14], are used to train neural networks in solving the addressed problems.

To detect the face, the frontal face detector provided by *Dlib* is used. The detector needs a grayscale image as input and returns a list of objects, where each object represents a face found in the image and provides information about it, such as the border locations. The camera image is captured and converted into a grayscale image using OpenCV, an open source computer vision and machine learning software library.

The first face from the list returned from the detector is used, assuming there are no other faces detected in the image, which never caused any trouble while only one person was present in the image.

In the next step, the facial key points are derived using the shape predictor provided by *Dlib*. To create a shape predictor, a trained database has to be downloaded first, which will then be provided to the shape predictor. The used database is a database with 68 relevant facial landmarks and can be downloaded at http://dlib.net/files/. After the shape predictor is created, it can be given the grayscale image of the face and the face object provided by the frontal face detector and will determine and return the locations of those 68 facial landmarks, which then can be used for further processing.

![Figure 1 Eye detection by the landmarks 36, 39, 42 and 45 of the shape predictor provided by Dlib](image1)

Figure 1 shows the facial landmarks returned by the shape predictor. The next task is to derive the eye locations from those landmarks. To reach that goal, the landmarks 36, 39, 42 and 45 are used, which present the left and right outward locations of the respective eye. In an approach to approximately determine the center of the eye, the mean location of these two landmarks is calculated as shown in Figure 2, which is not exactly the center, but the best result to receive from this data. The upper and lower landmarks given for each eye are not used, as they mark the eyelids and therefore move if the user opens or closes his or her eyes, whereas a fixed location of the eye is wanted.

![Figure 2 Location of the eye center based on the left and right landmark of the shape predictor](image2)

To this point, the implementation is straightforward and based on the free accessible toolkit *Dlib*. However, the detection of the pupil is a difficult task and has to be implemented manually. In the first step, the section containing the eye is extracted out of the camera image. As the pupil is built to absorb light, its brightness is usually the lowest compared to the surrounding area of the face, which makes the brightness to a possible property to filter by. Through experimenting it was discovered that the red channel of an RGB-image led to the best selectivity for the pupil against the surrounding area. Therefore, in the next step a grayscale image from the extracted section is created by only using the red channel. As the pupil should be the darkest area in the image, a binary filter is used, which turns every pixel in the image above the given threshold to white, every pixel below the threshold to black. Theoretically only the pixels belonging to the pupil are the ones that turn black, if the threshold is set correctly.
Practically there are same obstacles, for example bad or irregular lighting will lead to problems.

Figure 3 shows for example, how the threshold affects the accuracy of the pupil detection. On the left, the pupil is filtered out good, on the right the selected threshold is too high and other surrounding dark areas remain in the image, too. To select the proper threshold, the application starts with a threshold of zero and increases it, until a certain area is detected. The user can change the threshold manually if the result is not satisfying enough. To determine the center of the pupil, the center of the remaining area after filtering is calculated and used as location. As long as the lighting is good and the pupil is not covered, this approach works pretty well, if the simplicity of the algorithm is considered. Figure 4 shows a screenshot of a demo for the face detection.

Figure 5 shows another screenshot that demonstrates that the detection also works with (borderless) glasses.

Figure 6 shows how the reality gets captured by the camera. Using only one camera it is necessary to develop a projection model of the gaze direction in the computer screen. A main problem that occurs is, that the image contains no information about the absolute size or distance of the objects in it. Only the relative size of different objects to another within the image can be determined. As the approach is expected to be as simple as possible, these problems are not addressed directly and are handled by the calibration routine, which is described later in this section. There is also an impact by perspective distortions, which should usually be corrected by a fitting model.

The main goal, which is to realize gaze tracking by using an ordinary webcam, is also covered in [15], where neural networks were fed with images of the eyes in order to determine the target location. The authors in [16] and [17] also use neural networks to determine the gaze direction from the image and describe problems occurring with this approach, as for example bad generalization. In contrast to neural networks, this work aims to determine the target location by extracting specific values from the given image and feed them to a predefined model.

IV. DETERMINING THE TARGET LOCATION

After the detection and localization of the eyes and pupils are achieved, the target location has to be determined. As described in the previous sections, the location of the eyes and the gaze direction have to be determined in order to achieve that.
Figure 7 shows the model used to determine the target location, illustrated as a top view, only showing the x-axis. Determining the location of the eye seems rather simple, but it has to be taken into account, that various effects lead to the circumstance, that a movement of the eye in the camera image is not equal to the movement relatively to the computer screen in pixels. To keep the model simple, it is assumed that the movement in the camera image is proportional to the movement in the reality. According to the intercept theorems and the shown model, the distance between the pupil and the center of the eye is proportional to the distance between the location and the eye location projected on the screen. Further a constant was added to compensate occurring offsets, e.g. the offset between the camera image and the computer screen. To take both eyes into account, the target point is determined separately for each eye and finally calculated by using the mean value of the both target points. This model leads to the following equation per eye and per axis:

\[ d = \alpha \cdot d_1 + \beta \cdot d_2 + \gamma \]  

**Eq. 1**

Where \( d \) is the target location (x or y), \( d_1 \) is the location of the eye (left or right) and \( d_2 \) is the distance between the pupil center and the eye center both in the corresponding axis. The coefficients \( \alpha, \beta \) and \( \gamma \) have to be determined through calibration. What should be mentioned, is, that the algorithm assumes that the distance between the user and the computer screen does not change. If it would change, the used coefficients would have to change accordingly, which cannot be implemented with simple approaches. 

The calibration process is rather simple. The application shows several markers on the screen one after another. The user has to look at the marker and push a button to confirm that he or she is looking at the marked location. When the button is pressed, the current face detection data is appended to a list along with the shown screen location and the next marker is being shown. After the predefined locations were shown, the three coefficients \( \alpha, \beta \) and \( \gamma \) for each eye and axis have to be determined. As the model assumes that the solution is a linear equation with two independent variables \( d_1 \) and \( d_2 \), the three coefficients \( \alpha, \beta \) and \( \gamma \) can be determined by using the multiple linear regression. A linear regression model can be imported from the sklearn package and therefore must not be implemented manually. The model receives a list of vectors of several inputs along with the corresponding target locations in the function called `fit`. The target locations are drawn onto the computer screen, so the user looks at them while calibrating. After receiving those values, the linear regression model tries to determine the coefficients while using the least squares method to minimize the error over all input values. The calibration can be done several times if wanted, which would result in expanding the list of input values and the corresponding target locations and therefore minimizing statistical errors. The software creates four different linear regression models, one per every eye and every axis. After calibration, the models are given the input values received from the face detector continuously, so that a target location is determined for each eye separately. The final target location is then determined by calculating the mean value of both target locations.

V. FILTERS

To optimize the results of the algorithm, different filters were implemented, which can be switched on and off independently. Without any filters, the algorithm already is able to determine a certain area around the location the user is looking at, but that area is relatively large and the cursor tends to shake randomly within this area. The different filters aim to solve this problem.

One filter is the mean filter, which saves the determined screen location of the last 5 frames and calculates the mean value of them, therefore representing a floating mean filter. This filter increases the accuracy while maintaining a high responsiveness.

Another filter called time filter tries to calm the cursor by only moving it towards the new target location by a certain part of the distance instead of directly setting the new location. The increase of accuracy using this filter is low, while the responsiveness of the cursor is decreased noticeable.

The third filter is called grid filter. It divides the screen into a grid with at runtime changeable amounts of rows and columns. The cursor gets centered in the cell which contains the determined cursor location, so that the screen gets divided into a finite number of cells which can be focused separately. This filter can also be used as a benchmark for the accuracy that can be achieved, which is described in the next section.

VI. TESTING THE ALGORITHM

The minimum requirement is fulfilled if the user is able to generally move the displayed cursor in the general direction he or she is looking. The best case would be if the determined target location would match the real target location at any given time. To determine the achieved quality of the application, a test procedure has to be defined and executed by different users and under different circumstances.

The outcome of this work is an algorithm that should be able to be implemented easily on different systems. As the used programming language is Python and all hardware accesses are realized through generalized library functions, it can be run on all platforms that support Python.

In general, the algorithm works as intended, but a test procedure has to be defined to determine its quality. The grid filter is used for this purpose, along with the mean filter,
which increases the quality. It was defined that the user must be able to focus a specific cell for at least 2 seconds, which was assumed to be long enough to submit a selection in a software developed for this purpose. Starting with a rather small number of rows and columns, the number gets increased until the user is no longer able to focus on a specific cell. The highest number of rows and columns, where the user is able to focus every cell separately is used as the indicator for the achieved resolution. The number of cells that could not be focused at are recorded along with the cell number, named error cells. Figure 8 shows a screenshot of the test software while running a test.

![Figure 8 Visualization of the calculated gaze direction (orange circle) on the computer screen using mean filter with the last 5 (green) points and grid filter](image)

As described previously, the gaze model was intended to determine the target location by projecting the gaze direction onto the screen and adding it to the eye location. This approach was meant to make the algorithm robust against head movements. During first tests the impact of the head movement on the determined target location could indeed be minimized by calibrating several times with different head locations, but the general accuracy became very low, as the outer cells could not be focused anymore and the determined target location often received an offset along the horizontal axis. The low achieved accuracy led to the decision to only test the software with a fixed head location, meaning the user held his or her head still while testing. But it was discovered that movements of the eye location can be interpreted as changes in the face alignment, as it also is mentioned in [18].

A few tests confirmed that by still including the eye location in the model and tilting the face into the gaze direction, which also felt more natural, the accuracy could be increased. As the software is also meant to be used by people that possibly are not able to move the head at all, a gaze interaction only based on pupil movements should also be tested. Therefore, two different test cases were defined, the first one with no head movement at all, the second one with tilting the head into the gaze direction. Every user had to test both test cases in order to determine the usability for the given case. As the linear regression reacts very sensitively to head movements after the calibration was done without moving the head, the eye location in equation 1 was not used while testing the first case, which can be switched on or off in runtime.

The software was tested on two different systems. One system was a Microsoft Surface Book 2 with a 15 inch display running Microsoft Windows 10. The built-in camera was able to record in the resolution 1920x1080 pixels. The other system was a desktop with a 28 inch display and an external camera with a resolution of 1280x720 pixels, also running Microsoft Windows 10. By default, the camera image received through OpenCV was given in a resolution of 640x480 pixels. The resolution of the received image can be changed, but the main target was to test the software in different environments by different (looking) users, so that the default resolution was kept. Both systems reached a stable speed of around 10 to 15 frames per second without optimizing the code. That is fast enough for common eye-controlled applications that are not time critical in user interaction. In this case it can be seen as real time when the response time from the user input to an application via gaze control up to 100 ms is acceptable. The test results are shown below.

**Table 1 Test results without head movement**

<table>
<thead>
<tr>
<th>User</th>
<th>System</th>
<th>Columns</th>
<th>Rows</th>
<th>Error Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Surface</td>
<td>7</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Surface</td>
<td>7</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Surface</td>
<td>7</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>Desktop</td>
<td>7</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Desktop</td>
<td>7</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Desktop</td>
<td>7</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2 Test results with head movement**

<table>
<thead>
<tr>
<th>User</th>
<th>System</th>
<th>Columns</th>
<th>Rows</th>
<th>Error Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Surface</td>
<td>17</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Surface</td>
<td>12</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Surface</td>
<td>12</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Desktop</td>
<td>15</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Desktop</td>
<td>15</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Desktop</td>
<td>15</td>
<td>12</td>
<td>0</td>
</tr>
</tbody>
</table>

As can be seen, the test results without head movement already seem to be good enough to interact with a computer by using software that is specifically designed for it, except for user 3. It has to be mentioned, that user 3 was wearing small reading glasses with a thick border, which probably disturbed the pupil detection. The other users testing on the Surface Book reached a high amount of focusable cells. All users testing on the desktop system had trouble to focus one of the cells located in a corner, but otherwise the results were good. By adding the eye location to the equation and tilting the head into the looking direction while calibrating and using the software, all users were able to receive results that were significantly better, especially user 3. In this use case, there were at least 120 cells focusable, user 1 even reached 255 focusable cells on the Surface Book, so it would be possible to integrate an exhaustive keyboard on the screen that could be
gaze controlled, or even for example navigate and select objects on a website that is designed in a more coarse style.

VII. DISCUSSION
In general, the test results correspond to some observations made while developing and testing the face detection algorithm. Determining the eye location was very stable and accurate, whereas the pupil location was often not centered correctly and tended to shake slightly, so that the eye location is the more reliable source to determine the target location. It can be assumed that the quality will increase further if the pupil detection quality gets improved.

While all users testing on the desktop system had very similar if not identical experiences, the users testing on the surface book experienced different accuracies. It has to be highlighted at this point, that the screen of the Surface Book is significantly smaller than the screen of the desktop system, therefore meaning that the same number of focusable cells indicate a higher accuracy on the Surface Book. User 1 achieved a very high resolution. User 2 gained a resolution that was not as high, where the impact of the pupil color (dark brown) could be relevant in this case and should be investigated in further studies. User 3 had massive problems focusing cells while only using the pupil detection, which could be caused by the small reading glasses with thick borders. In all cases, the achieved resolution was way higher and all cells were focusable when the head movement was included.

Caused by the lack of different test systems it can only be guessed which other circumstances may have had an impact on the results. First of all, both systems were tested at completely different locations with different light conditions, where it can be clearly mentioned, that the lighting has a significant impact on the quality of the results. Another impact could be the camera location: While the camera of the Surface Book is integrated directly and near the screen area, the desktop system used an external camera, which had to be placed in front of the screen. Another explanation could be found in the camera resolution. Even though the image received within the software had the same (low) resolution, it must have been downsampled at some point. The camera of the Surface Book records at a resolution more than 2 times of the resolution provided by the external camera used in the desktop system. At this point an effect could have had an impact similar to super sampling, a technique used to improve the image quality in videogames. Super sampling renders the image at a higher resolution than the screen is capable to show and downscales it afterwards, which leads to a better image quality. The same effect could have occurred in this case and therefore could have improved the detection.

The inaccuracy of the pupil detection can be explained by several causes. The first cause is, that the detection relies only on the brightness of the image, where it was assumed, that the whole pupil is the darkest area of the image. But the brightness of each pixel strongly depends on the lighting, which can be changed significantly by moving the head a little. Furthermore, the best threshold value is different for both eyes, but the effort to set different threshold values for both eyes is not worth it, because the best threshold value changes continuously with every small change in the lighting or head orientation. Providing homogenous lighting helped a lot in minimizing this. Also, the pupil reflects light in some areas, leading to some pixels within the pupil that are above the given threshold and therefore get filtered out. In conclusion the binary filter itself already creates an inaccuracy by leaving some pixels belonging to the pupil out while including others that are not belonging to the pupil. After that, another problem is, that the pupil is almost never completely visible in the upper and lower region of the eye, as it is more or less covered by the eyelids. Even if all, and only all of the pixels belonging to the visible part of the pupil were detected, this circumstance would lead to inaccuracies. A well-defined model of the pupil, that would be able to detect it based on other properties than just brightness and determine the location precisely based on the visible part of its shape should be able to deliver better results. But it has to be stressed at this point, that the target of this work was to realize gaze tracking by using an easy approach, which the previously described model would clearly not be.

Table 3 shows a sample of the determined coefficients according to equation 1 in order to verify that all of three coefficients $\alpha$, $\beta$ and $\gamma$ have a significant impact on the determined target location. As the table shows, all of the coefficients differ noticeable from zero and therefore have a significant impact.

<table>
<thead>
<tr>
<th>Eye</th>
<th>Axis</th>
<th>$\alpha$</th>
<th>$\beta$</th>
<th>$\gamma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>x</td>
<td>-51.39</td>
<td>-168.04</td>
<td>17107.48</td>
</tr>
<tr>
<td>Left</td>
<td>y</td>
<td>104.97</td>
<td>114.14</td>
<td>-13932.21</td>
</tr>
<tr>
<td>Right</td>
<td>x</td>
<td>-56.71</td>
<td>-168.04</td>
<td>22537.34</td>
</tr>
<tr>
<td>Right</td>
<td>y</td>
<td>105.60</td>
<td>155.41</td>
<td>-13807.17</td>
</tr>
</tbody>
</table>

VIII. CONCLUSION
As mentioned in the introduction, the aim of this project was to proof that a solution for gaze interaction with a computer that does not depend on special hardware and therefore is accessible for nearly everyone can be developed. As the time available for this project was limited, the target was to achieve a proof of concept rather than a solution that competes in quality with the ones offered by companies that are specialized on this topic.

Generally, it can be said that the target could be achieved. Using the free library Dlib, machine learning based algorithms to detect the eye location could be implemented fast and delivered a stable and accurate solution. The algorithm to locate the pupil on the other hand is not that accurate and tends to shake, but considering the simplicity of it, the result is surprisingly usable. Furthermore, the values and correlations used to determine the target location seem to be well-chosen, as the screen can be divided into a lot of cells that can be focused separately. As the eye location itself as indicator for head tilting seems to be the main contributor for leading to a high accuracy, it can be assumed that the solution can be improved a lot by enhancing the quality of the pupil detection.
As the software is made up very simple, there are plenty possible improvements that could be implemented later. First of all, as already mentioned, the accuracy can probably be enhanced a lot by improving the pupil detection. Furthermore, the distance of the user to the screen could be taken into account as well by estimating it through the size of certain facial structures. Also it should be investigated if it is possible that a single calibration for each system is enough to set it up for future use by different users, or maybe it is even possible that no explicit calibration is needed at all to create an usable experience. Another aspect that was not covered in detail, is the resolution of the used image. Using a higher resolution, if it is available, should also improve the accuracy. Furthermore, the algorithm should be advanced to detect blinking or other gestures in order to receive a confirmation of the user to actually confirm a selection. Another function that could be implemented, is a compensation of head movement, which would allow the user to move his or her head around in a certain range without decreasing the accuracy, an approach to this is described in [19].

In conclusion the developed method for gaze detection and interaction works as a proof of concept and already delivers a good quality if the simplicity of its approach is considered. It is possible to realize gaze interaction by only using the image received from an ordinary camera. Also there seems to be much potential to improve the algorithm and the achieved quality, so that the project can be described as a success.

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Effect of Vitomolt supplements in feed on growth and survival rate of white shrimp (*Litopenaeus vannamei*) seeds.

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**Abstract**- Feed is a very important factor in vaname shrimp aquaculture. The addition of phytoecdysteroid supplements (vitomolts) to the feed can increase protein retention, thus the shrimp growth will be better. This study aimed to determine the appropriate dose of Vitomolt supplement in feed for growth and survival of vaname shrimp seeds. The results of this study are expected to be useful in determining the best Vitomolt supplementation in the vaname shrimp feed formulation. The experimental animal used was the vaname shrimp seeds with an average initial weight of 1.5 g per individual. The research design used was a completely randomized design (CRD) with 4 treatments, namely treatment A without Vitomolt supplement, B 1.5 g Vitomolt /kg feed, C 3.0 g Vitomolt/kg feed, and D 4.5 g Vitomolt /kg feed. Each treatment had 3 replications, hence there were 12 experimental units. The experimental feed application was carried out for 40 days of maintenance. The results showed that the treatment of Vitomolt supplement dosage in the feed had a significant effect on the daily growth rate and survival rate of vannamei shrimp. The results of further tests showed that the vitomolt dose of 4.5 g/kg of feed was significantly different from the treatment without vitomolts, but did not differ from those with 1.5 g and 3.0 g/kg of feed. Vitomolt dose on the daily growth rate of vannamei shrimp. Furthermore, the Vitomolt dose of 3.0 g/kg of feed was significantly different from the treatment without Vitomolt but not significantly different from 1.5 g and 4.5 g/kg of feed. Vitomolt dose, on the survival rate of the vaname shrimp seeds. Based on the results of this study, it is recommended to add 3.0 g/kg of vitomolt for vaname seeds feed.

**Index Terms**- feed, growth, survival rate, Vitomolt

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**I. INTRODUCTION**

In an intensive vaname shrimp culture system in ponds, feed is one of the strategic components that determine the success of the business. In these activities, nearly 60-70% of the total production costs are used for the purchase of feed (Haryati et al. 2009; Haliman and Dian, 2005). The high price of commercial shrimp feed is due to the fact that almost 100% of the fish meal used as a protein raw material is imported from other countries. Therefore, the amount of protein in the feed must be limited, protein is optimized only for growth, while energy needs are met from carbohydrates (*protein-sparring effect by carbohydrates*) which are cheaper (Rosas et al. 2001). However, the problem is when the protein content of the feed is low, the potential for protein retention by cultured organisms is also low. It is in this condition that the vitomolts as phytoecdysteroids play an important role in increasing protein retention (Klein 2004, Fujaya et al. 2011).

According to Aslamyah (2000), one of the efforts to reduce protein composition in feed, without disturbing the growth of cultivated organisms is to use steroid hormones. This occurs, because steroid hormones are receptors that carry protein into cells, so that they can activate protein metabolism. Spinach extract, which is a phytoecdysteroid including the steroid class, when added to feed, in addition to accelerating molting and growth, is also expected to increase the efficiency of feed protein utilization. The results showed that vitomolts can retain protein up to > 40%. Thus, vitomolts not only have the potential to reduce feed prices and aquaculture management costs, but also play a direct role in increasing production. Experience with crab can be applied to shrimp with a few adjustments. Because the growth of crab and shrimp are both controlled by the molting hormone in the form of ecdysteroid.

The results of research by Wahyuningsih (2008) and Susanti (2009) suggest that the right dose of ecdysteroid will stimulate crustaceans to molt optimally, while low doses cannot stimulate molting, otherwise too high doses cause inhibition. Molting is an important initial phase for crabs and shrimp because by molting they can experience growth. This indicates that the ecdysteroid dose plays an important role in vitomolt supplementation in the feed. Until now, the dose of vitomolts as a supplement in vaname shrimp feed has never been studied, so it is necessary to do research on this matter. It is hoped that this research will produce low protein vaname shrimp feed with vitomolt supplements as ecdysteroid so that shrimp growth can be faster and the impact of nitrogen waste into the environment is minimal.

**II. METHODOLOGY**

The research was conducted at the Mini Hatchery, Faculty of Marine Sciences and Fisheries Hasanuddin University. The containers used in this study were 12 glass aquariums with a
capacity of 72 liters and filled with 56 L of brackish water for each aquarium. The water used is sea water that has been diluted to reach a salinity of 25-27 ppt. The test animal used in this study was juvenile shrimp with a weight of 1.5 g per individual. Each container is scattered with 20 vaname shrimps. Before giving the test feed, the shrimp were adapted to commercial feed for a week. This is so that the shrimp gets used to eating pellets. After the adaptation period is complete, the test shrimp are fed according to the treatment.

This study used a formulated feed with a low protein composition. The feed raw materials for the formulations are sourced from fish meal, soybean flour, corn flour, sweet potato flour, CMC, vitamin, mineral mix and fish oil as well as vitomolts as a supplement. Feed making begins by pulverizing all the dry ingredients used. All materials are weighed as needed and placed in plastic bags.

All dry feed ingredients are mixed starting from small amounts of fine ingredients followed by large amounts of raw materials, then stirring until they are well blended. Furthermore, added fish oil, vitamin and mineral mix. After it is evenly mixed, 400 mL of warm water is added to the mixture of 1 kg of feed raw materials to form a dough/paste. The feed dough is stirred until it doesn't stick to the hands. Then the dough is put into a feed molding device and molded into pellets. The pelletized feed is spread regularly on trays and dried in the sun to dry (Zainuddin et al. 2019). The dry pelleted feed is mixed with vitomolts according to the treatment dose. The feed that has been mixed with vitomolts is air dried and stored in a plastic jar and labeled according to treatment.

The formulated feed which was tested according to the treatment was randomly placed into the seed rearing medium. The amount of feed given is 10% of the body weight of the seeds (Zainuddin et al. 2020). Feeding is done with a frequency of four times every day, namely 06.00 AM, 10.00 AM, 14.00 PM and 18.00 PM. The test feed application was carried out for 40 days of maintenance to see the response to be measured.

Shrimp growth data were taken per week by sampling shrimp in each aquarium. Shrimp weight was weighed using a digital scale with a capacity of 500 g. Growth sampling was carried out every week to determine the increase in body weight of shrimp and to adjust feed. The method used is an experimental method by applying vitomolt supplementation at various doses as a treatment. The experimental design used was a completely randomized design (CRD) with 4 treatments, namely A without vitomolt supplementation, B 1.5 g vitomolts / kg feed, C 3.0 g vitomolts / kg feed, D 4.5 g vitomolts / kg feed. Each treatment had 3 replications in order to obtain 12 experimental units.

The measured research parameters measured in this study are:

1. Survival Rate (SR)
   \[ \text{SR} = \frac{\text{N}_t}{\text{N}_0} \times 100 \]
   where:
   \( \text{N}_t \) = number of individuals at the end of the study (individu)
   \( \text{N}_0 \) = number of individuals at the beginning of the study (individu)

2. Specific growth rate (SGR)
   \[ \text{SGR} = \frac{\text{Ln} W_t - \text{Ln} W_0}{t} \times 100 \]
   Where:
   \( W_t \) = average individual weight at the end of the study (g)
   \( W_0 \) = average individual weight at the beginning of the study (g)
   \( t \) = maintenance time (days)

Data were analyzed using analysis of variance (ANOVA) using SPSS version 24 software.

### III. RESULTS AND DISCUSSION

#### Daily Growth Rate

The average daily growth rate of vaname shrimp at the end of the study is presented in Table 1.

Table 1. Daily growth rate (DGR) of vaname shrimp during the study

<table>
<thead>
<tr>
<th>Vitomolt dose (g/kg of feed)</th>
<th>DGR (%/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Control</td>
<td>2.11 ± 0.29a</td>
</tr>
<tr>
<td>(B) 1.5</td>
<td>2.39 ± 0.41ab</td>
</tr>
<tr>
<td>(C) 3.0</td>
<td>3.04 ± 0.51ab</td>
</tr>
<tr>
<td>(D) 4.5</td>
<td>3.38 ± 0.32b</td>
</tr>
</tbody>
</table>

Note: Different letters in the DGR column indicate significant differences between treatments (P <0.05)

The results of analysis of variance (ANOVA) showed that the addition of vitomolt to pelleted feed had a significant effect (p <0.05) on the daily growth rate of vannamei shrimp. Furthermore, the results of W-Tuckey's further test showed that the vitomolt dose of 1.5 g / kg of feed and 3.0 g / kg of feed was not significantly different from the control treatment, but the vitomolts dose of 4.5 g / kg of feed was significantly different from the control. The three treatments of adding vitomolts in the feed were not significantly different from the daily growth rate of vaname shrimp during the study.

The results of this study indicated that the higher the dose of vitomolts added to the feed, the higher the daily growth rate of vaname shrimp (Table 1). This shows that the addition of vitomolts as phytoecdysteroid plays an important role in the growth of vaname shrimp. As it is known that molting is an important initial phase for crabs and shrimp because by molting they can experience growth. Soumoff & Skinner (1983), the edcyson hormone is able to increase the molting process in crustaceans where the stimulation process of the molting hormone in the premolt phase has an impact on the rapid molting period and the synchronization of the molting period. The edcyson hormone thus has a good impact on metabolism and the molting period in crab larvae. Gunamalai et al. (2003) also stated that ecdy steroid is the main steroid hormone in arthropods that regulates physiological functions, such as growth, metamorphosis, and reproduction.

Burdette (1962) in Klein (2004) also states that ecdysteroid apart from being a molting hormone also plays a role in increasing protein formation through increased mRNA synthesis. Donalson et al. (1978) stated that the most prominent metabolic action of steroids is the activation of protein metabolism. Protein synthesis is the most basic growth process, without large-scale protein production, growth will not occur (Jobling et al., 2001). The results of this study also showed that even though the protein content in the diet was low, only about 30%, the presence of...
ecdyysteroid supplementation, the body’s protein formation was still high. This is relevant to Burdette (1962 in Klein 2004) explanation that ecdysteroid plays a role in increasing protein synthesis. According to Turner & Bagnara (1976), hormones not only play a role in stimulating action but also inhibiting action. There is a negative feedback mechanism in hormonal action. High hormone concentrations in the circulation give an indication for cells to perform inhibition in order to maintain balance (homeostasis).

IV. SURVIVAL RATE

The average survival rate (SR) of vaname shrimp at the end of the study can be seen in Table 2.

Table 2. Average survival rate of vaname shrimp at the end of the study

<table>
<thead>
<tr>
<th>Vitomolt dose (g/kg of feed)</th>
<th>SR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Control</td>
<td>48.33 ± 20.82*</td>
</tr>
<tr>
<td>(B) 1.5</td>
<td>75.00 ± 5.00b</td>
</tr>
<tr>
<td>(C) 3.0</td>
<td>80.00 ± 5.00b</td>
</tr>
<tr>
<td>(D) 4.5</td>
<td>76.67 ± 7.64b</td>
</tr>
</tbody>
</table>

Note: Different letters in the SR column show significant differences between treatments (P <0.05)

The results of analysis of variance (ANOVA) showed that the addition of vitomolts to pelleted feed had a significant effect (p <0.05) on the survival rate of vaname shrimp. Furthermore, the results of W-Tuckey’s further test showed that the vitomolt dose of 3.0 g / kg of feed was significantly different from the treatment without vitomolt but not different from the dose of 1.5 g and 4.5 g / kg of feed against the survival rate of vaname shrimp seeds. The role of vitomolt as a supplement in feed is also seen in the survival rate of vaname shrimp. It can be seen that the vitomolt dose of 3.0 g / kg of feed is the optimum dose and when the dose is increased to 4.5 g / kg of feed, the survival rate of vaname shrimp decreases (Table 2). This shows that excess vitomoltt suppletion actually has a negative impact on the survival rate of vaname shrimp. The results of research by Wahyuningsih (2008) and Susanti (2009) suggest that the right dose of ecdysteroid will stimulate crustaceans to molt optimally, while low doses cannot stimulate molting, otherwise too high doses cause inhibition.

V. CONCLUSIONS AND SUGGESTIONS

The results showed a good response of the test shrimp with the application of vitomolts in feed. Vitomolt dose 3.0 g / kg of feed is the best treatment compared to other treatments. Based on the results of this study, it is recommended that the addition of vitomolts of 30 mg / kg of vaname shrimp seed feed is recommended.

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AUTHORS

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Effect of Entrepreneurial Competencies On Profitability of Quoted Manufacturing Firms in Nigeria

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Abstract- Entrepreneurship is vital in creating and fulfilling a healthy economy. Nigeria business environments which are currently witnessing rapid development and changes on the economic, human, technological and industrial sector, aspire to meet the difficult tasks of today’s operating industrial instability, with emphasis been laid on the various components of functional competencies of the firms. The main objective of the study is to evaluate the impact of entrepreneurial competencies on profitability of firms in Nigeria manufacturing industry. The specific objectives are to: establish the effect of total personnel cost to total production cost (TPPC) ratio on return on asset (ROA) of firms in the Nigeria manufacturing industry, evaluate the impact of total equity to total asset (TETA) ratio on return on asset (ROA) of Nigeria manufacturing firms. To achieve these objectives, ex-post factor research design was adopted. The population of the study was 4 selected manufacturing firms quoted on Nigeria stock exchange in Nigeria. The study covered a period of sixteen (16) years (2002-2017) gathered from various annual reports of firms in Nigerian manufacturing industry. The sample of the study focuses on the four listed manufacturing firms in Nigeria among which are Nigeria breweries Plc, Guinness Nigeria Plc, Nestle Nigeria Plc and Uni-lever Nigeria Plc. The method of data analysis was Panel multiple regression. The summary of findings are listed as follows: Total personnel cost to production cost ratio (TPPC) has positive but not significant effect on return on asset (ROA) of firms in Nigeria manufacturing industry (t – statistics (1.342627) < Critical values (1.681), total equity to total asset ratio (TETA) has no significant effect on return on asset (ROA) of Nigeria manufacturing firms (t – statistics (1.342627) < Critical values (1.681). The study concludes that there is positive insignificant impact of entrepreneurial competencies on profitability of firms in Nigeria manufacturing industry. The study also concludes that entrepreneurial competencies; production competencies, production competencies, human resources competencies, marketing competencies and entrepreneurial competencies affect the profitability of manufacturing firms in Nigeria. Entrepreneurial competencies were discovered to account for a positive and significant effect on the return on equity (ROE) which suggests it has impact on the profitability of manufacturing firms in Nigeria. The study recommended that the management of Nigeria manufacturing industry should review and continually put work in line with the profit plan of the organization. As a result, policies pertaining capital structure, firm earnings and asset management should be emphasized.

Index Terms- Entrepreneurial Competencies, Profitability and Quoted Manufacturing Firms

I. BACKGROUND OF THE STUDY

Entrepreneurship has been debated among scholars, educators, researchers, and policy makers since the concept was first established in the early 1700’s. The term entrepreneurship comes from the French verb entreprendre and the German word unternehmen, both mean to “undertake” Entrepreneurship has becoming crucial to every country ever since the age of globalization because the growth of entrepreneurial activities will help in creating jobs for the society and reducing the unemployment rate. Nafukho and Muyia (2010) submit that entrepreneurship is vital in creating and fulfilling a healthy economy. This is supported by Dickson, Solomon and Mark Weaver (2008) where growth of entrepreneurship is significant to a country’s economy.

Entrepreneurial process is ‘involving all the functions, activities, and actions associated with perceiving of opportunities and creation of organizations to pursue them Bygrave and Hofer (1891)’. Joseph Schumpeters introduced the modern definition of entrepreneurship in 1934. The carrying out of new combinations we call ‘enterprise, and the individuals whose function it is to carry them out we call entrepreneurs. Schumpeter tied entrepreneurship to the creation of five basic new combinations namely: introduction of a new product, introduction of a new method of production, opening of a new market, the conquest of a new source of supply and carrying out of a new organization of industry.

Nigeria business environments which are currently witnessing rapid development and changes on the economic, human, technological and industrial sector, aspire to meet the difficult tasks of today’s operating industrial instability, with emphasis been laid on the various components of functional competencies of the firms. The competencies are evaluated from the viewpoint of resources and capabilities required to drive the comparative advantage of various firms in Nigeria manufacturing industry, with stress on production, marketing, human resources, research and development, and entrepreneurial competencies (Nguyen, 2008). The capabilities required to drive an advantage include designing new products, installing new production technologies, adapting training programs, using quality control technologies and improving supplier relationships. Some
innovations result from revolutionary changes in strategy, but others are series of small, incremental changes (Cetin, 2010). Li (2000) posited that new technology, new products, new market, new manufacturing techniques and new management concepts are continuously emerging to change the comparative advantage of the companies. Competence is the ability of an individual to do a job properly. A competency is a lot of defined practices that give an organized guide enabling the identification, evaluation and development of the practices in individual employees. The term "fitness" first showed up in an article written by White (1959) as a concept for performance motivation. The term gained traction when McClelland (1973) wrote a seminal paper titled, "Testing for Competence Rather than for Intelligence". It has since been advanced by Richard Boyatzis and many others, for example, Gilbert (2008) who utilized the concept in relation to performance improvement. Its utilization changes generally, which prompts considerable misunderstanding.

A few researchers such as Masoud (2013), Nguyen (2008) see "capability" as a combination of commonsense and theoretical information, subjective aptitudes, conduct and qualities used to improve performance; or as the state or quality of being satisfactorily or all around qualified, having the capacity to perform a particular job. For instance, management competency may include systems thinking and emotional intelligence, and abilities in influence and negotiation. Competency is additionally utilized as an increasingly broad description of the necessities of human beings in organizations and networks (Fischer, and Henkel, 2010).

Jasperson, Carter and Zmud (2005) opine that competency is sometimes thought of as being shown in action in a situation and context that may be distinctive whenever a person has to act. In crises, capable individuals may respond to a situation following practices they have recently found to succeed. To be skillful, a person would need to have the option to interpret the situation in the context and to have a repertoire of potential actions to take and have trained in the potential actions in the repertoire, if this is relevant. Notwithstanding training, competency would develop through involvement and the degree of an individual to learn and adjust. In any case, research has discovered that it is difficult to assess competencies and fitness development. A competency is the combination of learning, expertise, and/or capacity one needs to effectively perform a vocation function.

A few investigations linked performance to firm competencies. Competencies encourage the transformation of organizational resources into qualities offering for the manufacturing firms. La, Patterson and Styles (2005) posit that the notion of firm competencies is akin to the resource based view (RBV) where firms are seen as particular heap of resources and abilities. Wheelens and Hunger (2007), hold that a firm develops through strategic management in request to adapt to the changing scene. It makes managers and individuals from the organization to be cognizant to new chances and dangers in a quickly changing environment.

Nigeria manufacturing industry is made up of sectors, for example, oil and gas, industrial merchandise, consumer products, material, medicinal services, conglomerates, and Agriculture. As a resource based sector of the Nation’s economy, it currently works thirteen activities viz; oil refining, bond, sustenance, drinks and tobacco; attire and footwear, wood and wood products; non-metallic products; plastic and elastic products; electrical and electronic; basic metals, iron and steel; motor vehicles and assembly and other manufacturing. In spite of the fact that the sector in Nigeria cannot reasonably bolster economic development in its present performance level, it has incredible possibilities since Nigeria is one of the nations with most attention-grabbing markets in the West Africa, with over 180million consumers and millions additional customers in the economically reliant neighboring nations. The importance of the manufacturing sector is additionally acknowledged from the way that private consumption uses are significantly increasing in the nation. Be that as it may, many issues are impeding the growth of the manufacturing industry in Nigeria and accordingly; the nation is progressing in all respects gradually towards economic diversification. Therefore, it is in the light of this that this study will examine the effect of entrepreneurial competencies on profitability of quoted manufacturing firms in Nigeria.

II. STATEMENT OF THE PROBLEM

Upon several Government policies and efforts towards stabilizing Nigeria economy through manufacturing industry, there are lots of challenges facing the growth and profit potentials of manufacturing firms, as identified by researchers. These challenges include but not limited to inappropriate and ineffective policies (Anyanwu, 2007); lack of integrated business plan and absence of harmonized and coordinated fiscal policy (Onoh, 2007); gross mismanagement of resources and lack of potentials for rapid growth and development of production efforts. Despite the emphasis placed on management of the economy, the manufacturing sector inclusive, Nigerian economy is yet to come to the path of sound growth and development because of low input of the sector to the GDP of the economy.

Companies in the manufacturing sector usually need resources and capabilities to enable them to grow and develop their operating activities. However, where the impact of such resources and capabilities becomes such that their cost implications rises against the market growth plans and profit potentials of the firm’s product, possible erosion of business share which inadvertently leads to business failure ensues. In view of the above therefore, firms in the manufacturing industry should as a matter of necessity identify the various components of competencies that are directly or indirectly involved in the operating activities of the firm. In the quest and struggle to gain comparative advantage in production amidst holding an appreciable market stake in the industry, firms need to evaluate the efficiency of the various competencies in line with the value maximization and profit plans of the organization. This needs to be carried out continually, to guaranty the going concern status of the business. The essence of timely review of the firm’s policies relating to the managing cost of resources and capabilities cannot be over emphasized, as such will enhance cost savings and increase market value.

Hamel (1994) posited that functionality related competence enable ‘firms’ to provide its services and products with unique functionality, hence investing in the product with distinctive customer benefits, rather than only making it incrementally better. This is because firms are converging around universally elevated standards for products and service integrity and are expose to
alliances, acquisitions and industry consolidation to build broadly matching global brand and distribution capabilities. It is against this backdrop that the research effort focuses on investigating the effect of entrepreneurial competencies on the profitability of firms in Nigeria manufacturing industry.

III. OBJECTIVES OF THE STUDY

The main objective of the study is to evaluate the impact of entrepreneurial competencies on profitability of firms in Nigeria manufacturing industry. Specifically; the objectives are to:

i. Establish the effect of total personnel cost to total production cost (TPCPC) ratio on return on asset (ROA) of firms in the Nigeria manufacturing industry.

ii. Evaluate the impact of total equity to total asset (TETA) ratio on return on asset (ROA) of Nigeria manufacturing firms.

IV. RESEARCH HYPOTHESES

The hypotheses for the study have been formulated. These null hypotheses are as follows:

I. Total personnel cost to total production cost (TPCPC) ratio has no significant effect on return on asset (ROA) of firms in the Nigeria manufacturing industry.

II. Total equity to total asset (TETA) ratio has no significant effect on return on asset (ROA) of Nigeria manufacturing firms.

V. LITERATURE REVIEW

Competencies

Per-Erik and Henrik (2008) explain the meaning of capability from three points of view viz: formal, real and competencies-in-use. Accordingly it is considered as a characteristic of the employee that is, as kind of human capital or a human resource that can be translated into certain degree of performance formal skill is measured in terms of the long stretches of school finished and by the accreditations gotten by an individual.

Ellstrom (1997) viewed capability in terms of the necessities of the task that constitute a certain activity all the more explicitly, it will be utilized to allude to a limit of an individual (or a group) to effectively (according to certain formal or informal criteria, set independent from anyone else or by another person) handle certain situation or complete a certain task or employment.

VI. ENTREPRENEURIAL COMPETENCIES

A few investigations have linked performance to firm competencies. Competencies encourage the transformation of organizational resources into qualities offerings for the manufacturing firms. La, Patterson and styles (2005) place that the notion of firm competencies is akin to the resources based view (RBV) theory where firms are seen as peculiar groups of resources and abilities.

The distinctive competencies of any firm emerge from two sources viz; its resources (man, machine, materials, land, condition of craftsmanship, techniques) and abilities. According to Nguyen (2008), a differentiating competency is capacity that enables one firm to accomplish unrivaled efficiency, quality, innovation or customer responsiveness and thereby to attain an upper hand. Winterton, Delamare, and Stringfellow (2005) make the following identicalness: information is the psychological ability; aptitudes belong to functional skill; and properties are linked with social capability. Vorhies, Morgan and Autry (2009) additionally demonstrate that it isn't sufficient to have resources and abilities which are significant, uncommon and hard to duplicate, how capacities are sent is increasingly important for creating and sustaining upper hand than their minor possession.

Mahadalle and Kaplan (2017) held that the encouraging results of organizational achievement emerging from productive business enterprise have driven scholastic and administrative attention on concepts of entrepreneurial competencies in the last couple of decades. Competencies of business visionaries have prompted more achievement in business, and it gives the sustainable upper hand. Profitable aptitude, learning, and the capacity to go for broke, birth and survival are a portion of the factors which are intently associated with the entrepreneurial competencies which have as very much created the effective performance of Business endeavor. Lazar and Paul (2015) contemplated the entrepreneurial competencies in a business endeavor. According to Mohammad and Sidek (2013) entrepreneurial competencies intercede the relationship between the growth of microfinance and the small businesses.

Each business organization need effective managers to be fruitful in today's exceptionally focused and dynamic business environment (Velu & Manxhari, 2017). It is important for a business organization to distinguish, create and retain capable individuals. Each fruitful and effective manager has a few competencies that empower him to perform productively and effectively at various managerial levels. The competencies can identify the contrasts among normal and incredible managers. The relationship between managerial competencies and business achievement still remains an important issue within organization literature (Crooke, Todd, Combs, Woehr and Ketchen 2011). According to Tehseen and Ramayah, (2015), many researchers have discovered that the entrepreneurial competencies are identified with the performance of endeavor. It is in this viewpoint that this work intends to extend the utilization of total equity to total asset ratio as intermediary for entrepreneurial competencies to assess the impact it has on profitability of firms in Nigeria manufacturing sector, subsequently the hypothesis underneath:

VII. FIRM PROFITABILITY

Profitability is the essential objective of all business adventures. Without profitability, the business won't get by in the long run. So measuring current and past profitability and projecting future profitability is important. Profitability is measured with income and expenses. This is done with the guide of "income statement". Income statement is basically a listing of income and expenses during a timeframe (Usually a year) for the whole business. A business that is exceptionally profitable has the

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capacity to remunerate its proprietors with a large return on their investment.

Increasing profitability is one of the most important tasks of the business managers. According to Trkman (2010) business performance evaluation in a basic issue. Sharing their view, Sucipto, Okteviani and Rizal, (2015) alluded to business performance as the measuring stick used to quantify results accomplished by the firm for a period. Meanwhile, issue, for example, customer brand reliability, an increase in the volume of sales, customer satisfaction growth in pieces of the overall industry and satisfactory return on investment are integral components of firm performance (Morgan, 2012). Saeed, Shekoofeh and Mahnaz (2013) investigated relationship between human resource and worth included efficiency of human capital and an issued return on equity (ROE) as a measure of firm performance Waiganjo, Mukulu and Kahiri (2012) assert that performance has been traditionally conceptualized in terms of financial measures, for example, return on asset (ROA), return on equity (ROE).

Return on Asset (ROA)

Okwo and Ugwunta (2012), opines that return on asset indicates how profitable a company is with respect to its total asset and delineate how well management is employing the firms total asset to make profit. It is processed by dividing the profit after tax by the total asset of a firm.

Return on Equity (ROE)

Okwo et al defines return on equity as the measure of net gain returned as a level of investors equity. Return on equity measures a corporation's profitability by relating how much profit a company produces with the money investors have invested. ROE is communicated as a rate and determined as: ROE = Net income/investors equity

ROE is valuable for comparing the profitability of a company to that of other firms in a similar industry. It outlines how effective the company is, at turning the reserve put into the business to more noteworthy gains and growth for the company and investors. Exquisite, (2006) opines that return on equity (ROE) is a measure of the profitability of a business in relation to the book estimation of investor equity, otherwise called net assets or assets minus liabilities. ROE is a measure of how well a company utilizes investments to produce earnings growth. ROE is equivalent to a monetary year total compensation (after favored stock dividends, before common stock dividends), separated by total equity (excluding favored offers), communicated as a rate.

Appetizing (2006) further states return on equity is particularly utilized for comparing the performance of companies in a similar industry. As with return on capital, a ROE is a measure of management's capacity to produce income from the equity accessible to it. ROEs of 15-20% are for the most part considered great.

ROEs are additionally a factor in stock valuation, in association with other financial ratios. When all is said in done, stock costs are influenced by earnings per share (EPS), so stock of a company with a 20% ROE will by and large cost twice as much as one with a 10% ROE.

The advantage of low ROEs originates from reinvesting earnings to help company growth. The advantage can likewise come as a profit on common offers or as a combination of dividends and company reinvestment. ROE is less relevant if earnings are not reinvested. The sustainable growth model demonstrates that when firms pay dividends, earnings growth brings down. On the off chance that the profit payout is 20%, the growth expected will be only 80% of the ROE rate.

The growth rate will be lower if earnings are utilized to repurchase shares. In the event that the offers are purchased at a various of book esteem (a factor of x times book esteem), the incremental earnings returns will be decreased by that equivalent factor (ROE/x).

New investments may not be as profitable as the existing business. Ask "what is the company doing with its earnings?" ROE is determined from the company point of view, on the company in general. Since much financial manipulation is practiced with new offer issues and buyback, the investor may have an alternate recalculated esteem 'per share' (earnings per share/book esteem per share).

VIII. THEORETICAL FRAMEWORK

Production Efficiency Theory

The efficiency theory was propounded by Pareto, also called Pareto optimality. Morgan, Kaleka and Katsipeas (2004), posits that production efficiency is based on a business's ability to produce the highest number of units of a good while using the least amount of resource possible. The aim is to find a balance between the use of resources, the rate of production and quality of the goods being produced.

Efficiency in general describes the extent to which resources such as time, space, energy, etc are well used for the intended task or purpose.

Diffusion of Innovation Theory

This theory was developed by Rogers (1962) and one of the oldest social science theories. Diffusion research centers on the conditions which increase or decrease the likelihood that a new idea, product or practice will be adopted by members of a given culture. Diffusion of innovation theory predicts that media as well as interpersonal contacts provide information and influence opinion and judgment. Studying how innovation occurs, Rogers (1995) argues that it consists of four stages: Invention, diffusion (communication) through the social system, time and consequences.

2.3.3 Profitability Models

Profitability models are of great importance to a business because its primary goal and duty is to generate profit. A profitability model is a business structure established gradually by the business to attain profit in the process of market competition. For a specific type of business, it is a certain operational approaches that generate relatively greater sales and profit with relatively less input.

One key idea of the “golden rules for investment” proposed by the Paris school of business maintain that the most important thing for a business is not capital or its talents, it is the profitability model. The absence of a profitability model that is close and...
reason would make it difficult for a business to survive and grow.

IX. EMPIRICAL REVIEW

Entrepreneurial Competencies and Firms profitability

Competency-based management empowers an organization to integrate strategic human resources and business plans, by allowing organization to assess the current human resources limit based on their competencies against the limit needed for translating the strategic vision of an organization into the practices that employees must show for the organization to be fruitful, based on methodology have been connected to wide range of human resource works on including enrollment, motivation, training and performance management.

Antwi and Owusu (2015) planned to examine the relationship between employee's fitness and firm's performance among pharmaceutical companies in Ghana. Field overview involving 280 respondents was done to secure information used to test the hypothesis expressed for the examination. With the guide of linear regression analysis, the examination found that the independent factors (employee's fitness) has to a significant degree, some influence on the result of firm performance, thereby recommend that firm know about the colossal advantage that they enjoying because of having set up an effective and productive workforce. The investigation prescribed that firms need to take advantage of the lucky break to improve continuous leaning in their organizations in order to improve the abilities, frame of mind and conduct of employee towards the release of their individual tasks to have the option to attain superior penchant.

Gweyi and Karanja (2014) made endeavor to investigate the impact of financial leverage on the financial performance of store taking saccos in Kenya. The straightforward information was extricated from 40 savings and credit co-employable social orders (achievement) enlisted by saccos society regulatory specialist reached out from the time of 2010 to 2012. The secondary information utilized for the analysis was gathered from the financial statement of the different store taking saccos. Two basic methodologies spellbinding and analytical structures were received. The outcomes show ideal positive correlation between firm size with return on equity and profit after tax at 99% confidence interval and week positive correlation between financial leverage with return on assets and income growth.

Osuji and Odita (2012) in their paper examined the impact of firm size on financial performance of Nigerian firms using an example of thirty (30) non-financial firms recorded on the Nigerian stock exchange during the multi year time frame, 2004 to 2010. Panel information for the chose firms were produced and analyzed using ordinary least square (OLS) as a technique for estimating. The outcome demonstrates that a firm's size surrogated by debt ratio has a significantly negative impact of the firm's financial measures (return on assets, and return on equity). The investigation of their findings indicates consistency with period exact examinations and supplier proof on the side of organization cost theory.

Bassey, Aniekan, Ikpe and Udo (2013), using a sample of 60 unquoted agro-based firms Nigeria within a period of six years (2005-2010) from the agency cost theory point on view. They employed the Ordinary Least Square regression and descriptive statistics and revealed that only growth and educational level of firms owners were significant determinants of both firm size and age of the firms, gender of owners and export status impacted significantly on share price of quoted firms, while business risk, size and profitability of firms were major determinants of short term debt ratio for the firms under investigation.

Oke and Afobabi (2011), using a study of five quoted firms within a period of nine years (1999-2007) from the static trade-off and agency cost theory point of view. They employed the panel data regression model and revealed in their studya positive relationship between firms” performance and firm size as well as between firms’ performance and share price. There is also a negative relationship that exists between firms performance and share price to high cost of borrowing in the country.

Nguyen (2008) aimed to study the effect of functional competencies on manufacturing firms in Vietnam, A survey of 725 manufacturing companies in Vietnam was conducted to identify the effect of functional competencies in terms of marketing, research & development, manufacturing, and human resource on firm performance in terms of market performance and profitability. Consequently 125 questionnaires were returned back at response rate of 17.24%. The finding supported a positive relationship between the functional competencies and firm performance. It found that manufacturing firms in Vietnam were not performing well in these functional competencies, and firms were better in manufacturing competencies than marketing competencies.

Gichunge (2007) examined the effect of formal strategic management on organisational performance of medium sized manufacturing enterprises in Nairobi Kenya. He investigated the effect of various administrative/legal factors on the extent to which formal strategic management are adopted, and also determined the relationship between level of competition and formal strategic management. He selected eighty medium enterprises (MEs) using simple random sampling. Primary data was collected using a semi-structured questionnaire. Results showed that the MEs have not fully adopted formal strategic management and that administrative/legal factors and competition influence adoption of strategic management.

Malhotra (2010) examined the influence of strategic management on corporate performance in selected small scale enterprises in Lagos, Nigeria. Cross sectional survey research method was adopted for the study and 140 participants were randomly selected among small-scale enterprises in Lagos metropolis. Findings of the study showed that strategic management enhances both organizational profitability and company market share.

Askarany and Yazdifar (2012), investigated the diffusion of six proposed strategic management tools of the past few decades through the lens of organizational change theory, examined the relationship between the adoption of these techniques and organizational performance in both manufacturing and non-manufacturing organizations in New Zealand. The findings suggested a significant association between the diffusion of these relatively new strategic management tools and organizational performance.

Muogbo (2013) examined the impact of strategic management on organisational growth and development in selected manufacturing firms in Anambra State, Nigeria. The
study used a descriptive survey design to collect detailed and factual information. Cluster sampling was used to select equal number of manufacturing firms from each sample cluster in the study. The data collection instrument was a structured questionnaire. He found out that Strategic management was not yet a common business practice among manufacturing firms in Anambra State.

Okwo and Ugwunta (2012) investigated the effect of input costs on profitability of brewing firms in Nigeria. A cross sectional data was gathered from the annual reports of the studied firms for a period of 1999 – 2010. The ordinary least square (OLS) stated in the form of a multiple regression model was applied in the analysis. The study found that the effect of focal variable RSGAE (Ratio of Selling and General Administrative Expenses) is statistically positive and impacted on profitability of the brewing firms in Nigeria.

X. METHODOLOGY

The study adopted ex-post factor research design that made use of secondary data to examine the effect of entrepreneurial competencies have on the profitability of selected manufacturing firms quoted on Nigeria stock exchange. The choice of the design was based nature of the data. The study covered a period of sixteen (16) years (2002-2017) gathered from various annual reports of firms in Nigerian manufacturing industry. The sample of the study focuses on the four listed manufacturing firms in Nigeria among which are Nigeria breweries Plc, Guinness Nigeria Plc, Nestle Nigeria Plc, Uni-lever Nigeria Plc. The choice of the companies was because of their domination and impactful contributions with consumer goods leading with more than 52% of the total industry stake (National Bureau of Statistics, 2015) over the years. The method of data analysis was panel regression.

Model Specification

To analyze the respective relationships defined in prior sections, multiple regressions analysis is performed based on the following modification models as applied in other previous studies (Ahangar, 2011). The model been used is:

\[ \text{ROA}_i = \beta_0 + \beta_1 (\text{TPCT})_i + \beta_2 (\text{MET})_i + \epsilon_i \]  

Where:

- ROA = Return on Asset – indicates the firms’ profitability as measured by the firms’ returns expressed as a proportion of total asset.
- TPCPC = Total personnel cost to production cost ratio
- TETA = Total equity to total asset ratio
- \( \beta_0 \) = Constant term (intercept)
- \( \beta_1 \) = Coefficient to be estimated
- E = Error term

### Table 2: Multiple Panel Regression for testing Hypotheses

<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>TPCPC</td>
<td>0.012910</td>
<td>0.039747</td>
<td>0.324792</td>
<td>0.7466</td>
</tr>
<tr>
<td>TETA</td>
<td>0.042681</td>
<td>0.031789</td>
<td>1.342627</td>
<td>0.1849</td>
</tr>
<tr>
<td>C</td>
<td>0.076837</td>
<td>0.012795</td>
<td>6.005066</td>
<td>0.0000</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.835879</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.700820</td>
<td>S.D. dependent var</td>
<td>0.027985</td>
<td></td>
</tr>
<tr>
<td>S.E. of regression</td>
<td>0.027973</td>
<td>Akaike info criterion</td>
<td>-4.264795</td>
<td></td>
</tr>
<tr>
<td>Sum squared resid</td>
<td>0.043038</td>
<td>Schwarz criterion</td>
<td>-4.158220</td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>126.6791</td>
<td>Hannan-Quinn criter.</td>
<td>-4.223282</td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>1.023391</td>
<td>Durbin-Watson stat</td>
<td>1.845046</td>
<td></td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
<td>0.366115</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In testing this hypothesis, total personnel cost to production cost ratio (TPCPC) and total equity to total asset ratio (TETA) was regressed against Return on Asset(ROA). The result of the multiple panel regression analysis summarized in table 2 shows the model to evaluate the impact of entrepreneurialcompetencies on profitability of firms in Nigeria manufacturing industry.

**Return on Asset (ROA)** = \[ 0.076837 + 0.012910 \times \text{TPCPC} + 0.042681 \times \text{TETA} \]

The empirical result shows that the coefficient of total personnel cost to production cost ratio (TPCPC) and total equity to total asset ratio (TETA) have positive effect onReturn on Asset(ROA); it means that total personnel cost to production cost ratio (TPCPC) and total equity to total asset ratio (TETA) have
positive and direct influence on Return on Asset (ROA). The results of the test for total personnel cost to production cost ratio (TPCPC) was not statistically significant. This is because observed values of t – statistics (0.324792) was less than its critical values (1.681). The results of the t – statistics denotes that the coefficient of total equity to total asset ratio (TETA) was not statistically significant. This is because observed values of t – statistics (1.342627) was less than its critical values (1.681). The results of the F – test shows that the overall regression of the hypothesis one was not statistically significant. This is because observed value of the F – statistics (1.023391) was less than its critical value (3.2870). Again, our empirical result shows that the Pearson product moment correlation analysis (r) was 0.835879. The strength of relationship between the two variables was very high.

**Test of Hypothesis One**

However, we accept the null hypothesis and conclude that total personnel cost to production cost ratio (TPCPC) has no significant effect on return on asset (ROA) of firms in Nigeria manufacturing industry.

**Test of Hypothesis Two**

However, we accept the null hypothesis and conclude that total equity to total asset ratio (TETA) has no significant effect on return on asset (ROA) of Nigeria manufacturing firms.

**XI. SUMMARY OF THE FINDINGS**

This study has the following findings:

I. Total personnel cost to production cost ratio (TPCPC) has positive but not significant effect on return on asset (ROA) of firms in Nigeria manufacturing industry (t – statistics (1.342627) < Critical values (1.681)).

The study result indicated that cost effective strategies will enhance human resources efficiency

II. Total equity to total asset ratio (TETA) has no significant effect on return on asset (ROA) of Nigerian manufacturing firms (t – statistics (1.342627) < Critical values (1.681)). It suggests that the firms’ policies should be reviewed and continually made to work in line with the profit plan of the organization.

**5.2 Conclusion**

The study concluded that there is positive insignificant impact of entrepreneurial competencies on profitability of firms in Nigeria manufacturing industry. The study also concludes that entrepreneurial competencies; production competencies, production competencies, human resources competencies, marketing competencies and entrepreneurial competencies affect the profitability of manufacturing firms in Nigeria. From the findings, it is apparent that while production competencies relates negatively but not significant with return on asset, same positively affects return on equity, showing that efficient use of production capabilities will result to increased profitability and yield to equity. Human resources competencies are found to have positive but not significant effect on ROA and ROE which implies need for more cost effective strategies that will ensure human capital efficiency while maximizing derivable values from same.

Marketing competencies which were found to have positive but not significant effect on both ROA and ROE suggest that efforts, innovation and strategies deployed by firms in the industry, seem effective but require reviewed in order to achieve cost effective attraction, enhanced customer patronage and in turn increase sales. Entrepreneurial competencies were discovered to account for a positive and significant effect on the return on equity (ROE) which suggests it has impact on the profitability of manufacturing firms in Nigeria.

**5.3 Recommendations**

Based on the findings of this study, the following recommendations were made.

I. The management of Nigeria manufacturing industry should re-strategize cost of human resources in the sector that places burden on the total cost of goods available for sales as well as the profit margin of the business. Accordingly, Companies should adopt human capital value oriented strategies. Bearing in mind, the essentials of competent and competitive work force to firm’s survival in a rapid changing environment, companies should be provided with opportunity to develop programme and process to recruit, motivate and retain employees with capabilities to add value. This could be achieved through: creating effective and efficient personnel policies; providing professional training for managers; providing job training for workers; involving the employees in the decision making process; stimulating employee motivation, job satisfaction and morale; developing compensation and recognition based on performance.

The management of Nigeria manufacturing industry should review and continually put work in line with the profit plan of the organization. As a result, policies pertaining capital structure, firm earnings and asset management should be emphasized.

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Improved Livestock Breeds and Household Social Capital: The Case of Sahiwal Cattle Adoption among Isiria Maasai of Narok County, Kenya

Moses Kipainoi Saranta* and Taji Isindu Shivachi*

Abstract: The utilization of pastoral resources such as grasses, shrubs, water and salt-licks is an aspect social capital. However, with climatic and socio-economic changes traditional cattle production and livelihood outcomes including social capital may be impacted. As a result pastoralists devise mechanism to ameliorate any negative effects of the changes. Governments and other agencies have also intervened in the pastoral production systems to align them to current realities. In 1991, the Government of Kenya and the Federal Republic of Germany introduced the Sahiwal cattle to the Isiria Maasai of Narok County to improve cattle production. Studies on the effect of such interventions on social capital are few and the existing ones are narrowed to at most three aspects of social capital. Thus, this study was formulated to investigate the association between adoption of Sahiwal cattle and household social capital among Isiria Maasai pastoralists. The study considered ten aspects of social capital which adopted a cross-sectional social survey and it utilised both quantitative and qualitative methods of data collection and analysis. A multi-stage proportional sampling procedure was used to select a sample of 400 households to participate in the study. Results of the study indicated that over three-quarters (86.6%) of the respondents had adopted Sahiwal cattle and a majority (95.4%) had a moderate/medium level of social capital. Age and level of formal education had an effect on the level of social capital. Respondents scored highly on two aspects of social capital – friendship (84.4%) and information and communication (83.5%). Data revealed that the association between adoption of Sahiwal cattle and household social capital was negative, weak and not significant at the 0.05 level of significance. Nevertheless, the association was significant for any association between adoptions of improved cattle and overall household social capital, it may be possible that an association exists with some of its aspects.

Index Terms: Adoption, Livelihood, Outcomes, Sahiwal

I. INTRODUCTION

Up to 500 million people in the world rely on pastoralism to sustain their livelihood, mainly in arid and semi-arid regions [1]. Utilization of natural resources such as grasses, shrubs, watering and salt-licks for pastoral production is mediated by social capital, especially socio-cultural norms and relationships [2]. A pastoralist system of rights governs mechanisms of access to, alienation of, control over, exclusion from, management and withdrawal of resources. The systems of rights are guided by principles of mutual trust and reciprocity implemented through social institutions [3].

Nevertheless, in the recent past, pastoralists worldwide have experienced climatic and socioeconomic changes which have affected their traditional livestock production practices and outcomes including aspects of social capital which mediated the utilization of pastoral production resources. Changes in land tenure from common property systems to individual and state land have resulted in reduced grazing land which forced a reduction in the livestock numbers [4].

Other changes include attacks from neighbouring herding communities, encroachment of crop cultivators and major investment projects such as road construction, establishment of resort cities and airports [5]. Similarly, the areas occupied by pastoralists have also experience growth in human population which has exacerbated scarcity of pastoral production resources [6].

The climatic and socio-economic changes jeopardized the efforts of pastoralists to access sufficient resources necessary for the realization of their livelihood outcomes. As such they adopted numerous measures such as increasing food purchases, internal and external migration in Nepal [7], adopting crop cultivation in the Indian Himalaya [8], massive transportation of hay and supplementary feeds by the Chinese Tibetan plateau pastoralists [5] as well as changing the composition of herds and increasing grazing time by Bolivian pastoralists [9]. Other interventions undertaken by pastoralists include destocking in Benin [10], sedentarisation near urban centres [11] and marketing of milk and live animals in Kenya [5].

These efforts by pastoralists to address the effects of climatic and socio-economic changes that have affected pastoral production systems have been supplemented by government and non-governmental interventions. For instance, in Jordan and Israel government provided housing, food aid and drilled wells for
pastoralists as a mechanism of settling them [12]. In Thailand and Philippines, governments promoted improved tamed tilapia in poor rural households [13] while in the Lao Peoples Democratic Republic, production of cultivated forage was promoted [14]. Governments also promoted the adoption of improved crossbred dairy cattle in Bangladesh [15] and Senegal [16] and in Ethiopia, Kenya and Tanzania improved goats and sheep [17, 18].

Among the critical interventions undertaken to improve the livelihood outcomes for pastoralists in Kenya was the introduction of improved cattle breeds. In 1991, the Government of Kenya, with support from the Federal Republic of Germany initiated improved cattle production through an integrated multi-sectoral rural development programme – the Trans-Mara Development Programme (TDP). The programme aimed at improving pastoralist livelihood outcomes [19]. TDP introduced the Sahiwal breed of cattle among Isiria Maasai pastoralists of Narok County. The strategy adopted by TDP was cross-breeding; where traditional smallholder livestock producers obtained incentives to buy pedigree Sahiwal bulls and cross-bred them with their conventional Zebu cows.

Studies on the effect of adopting improved cattle breeds on social capital are few compared to those on the impact on household income and food security. Existing studies on the subject consider at most three aspects of social capital, which is really limiting. Thus, this study was formulated to investigate the association between adoption of Sahiwal cattle and household social capital by considering its ten aspects of membership to groups, friendship, solidarity with others and trust. The other social capital aspects considered included helping others, information and communication as well as level of interaction, sociability and safety. The study also considered the social capital aspect of empowerment and political action.

II. DATA COLLECTION

The design of the study was a cross-sectional social survey which employed quantitative and qualitative data collection and analysis methods. This study was undertaken in Narok County of Kenya and it targeted pastoral communities with a focus on Isiria Maasai. The sampling unit was the household while the unit of analysis was the household head. The sample size was 400 households selected using multi-stage proportional random sampling. Key informants were purposely selected. Primary data was collected from households using a questionnaire while a focus group discussion guide facilitated data collection from the focus groups. Data from key informants was collected using key informant interview guide.

Filled questionnaires were cleaned, coded and analysed using IBM SPSS version 26. Results were summarised using frequencies, percentages, mean, and mode and presented as tables, bar graphs, and histograms. To test for the association between the adoption of Sahiwal cattle and household social capital, the study relied on Spearman Correlation Coefficient and hypotheses tested using the P-value approach at the 0.05 level of significance. Qualitative handwritten data generated was typed into a word document, read several times back and forth in order to discern recurring categories, opinions and themes. Areas of agreement and disagreement were noted and interpreted.

III. STUDY FINDINGS

had a strong or high, moderate or medium, or a weak low social capital. The score allocated weighted points to items of the ten dimensions. An average overall score was calculated by finding the mean of the total summed scores. Respondents with a score of less than 3 were described as having a weak/low social capital while those with 3 to 6 and over 6 scores were described as having a moderate/medium and strong/high social capital respectively. The findings are presented in Figure 2.

As shown in Figure 1, more than three quarters of the respondents had adopted Sahiwal cattle.

A. Levels of Social Capital among Study Respondents

In the determination of respondents social capital the study designed a Social Capital Score (SCS) where respondents either
Figure 2 indicates that the majority (95.4%) of the respondents had a moderate/medium social capital. However, there were also numerous respondents with weak/low (2.7%) as well as strong/high (1.9%) social capital.

This study also compared respondents’ age, adoption of Sahiwal cattle, level of formal education and their social capital scores. Results of the comparisons are summarized in Table 1.

Table 1: Respondents’ social capital, age, Sahiwal cattle adoption and level of formal education

<table>
<thead>
<tr>
<th>Element</th>
<th>Frequency</th>
<th>Level of social capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of respondents</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>Below 25 years</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>25 to 34 years</td>
<td>0</td>
<td>105</td>
</tr>
<tr>
<td>35 to 44 years</td>
<td>2</td>
<td>84</td>
</tr>
<tr>
<td>45 to 54 years</td>
<td>2</td>
<td>65</td>
</tr>
<tr>
<td>55 to 64 years</td>
<td>3</td>
<td>34</td>
</tr>
<tr>
<td>65 years and above</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Not answered</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7</strong></td>
<td><strong>357</strong></td>
</tr>
<tr>
<td>Level of social capital</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>Sahiwal cattle adoption</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Strong/high</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Moderate/medium</td>
<td>49</td>
<td>308</td>
</tr>
<tr>
<td>Weak/low</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>356</strong></td>
</tr>
<tr>
<td>Level of formal education</td>
<td></td>
<td>Strong</td>
</tr>
<tr>
<td>None</td>
<td>2</td>
<td>114</td>
</tr>
<tr>
<td>Some Primary</td>
<td>1</td>
<td>77</td>
</tr>
<tr>
<td>Primary</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>Some Secondary</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Secondary</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>Tertiary</td>
<td>2</td>
<td>56</td>
</tr>
<tr>
<td>Not answered</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7</strong></td>
<td><strong>357</strong></td>
</tr>
</tbody>
</table>

Source: Survey data, October 2019

As indicated in Table 1, respondents’ data revealed that middle age (35 to 64 years) respondents were the only group with a strong/high social capital. There were no youthful (below 35 years) and elderly (65 years and above) respondents with strong/high social capital. Similarly, only Sahiwal cattle adopters had a strong/high social capital; not a single non-adopter respondent had this level of social capital. Data also revealed that although respondents who had higher (tertiary) or lower (primary and below) levels of education were likely to have a weak/low level of social capital; the evidence was stronger for lower levels of educational attainment.

B. Respondent’s Social Capital Dimensions

The study scored respondents on items for each dimension to obtain a total score for it. Results of the task indicated that respondents varied on their score for the ten dimensions of social capital. Figure 3 summarizes the respondents’ scores on the ten dimensions.

As shown in Figure 3, this study observed that more than half of the respondents scored 50% on eight of the dimensions. In particular, high scores were recorded for the two dimensions of friendship as well as information and communication where more than 80% of households had a score of 50% and above. A fairly high proportion of respondents had a score of more than 50% on safety, solidarity and helping others. On sociability, empowerment and political action and groups half of the households had a score of 50% and above. A majority of households scored less than 50% on the dimension of trust and interaction.

Study results revealed that a majority (80.7%) of the respondents belonged to some kind of group. Respondents mainly belonged to five types of group – merry-go-round (54.4%), age-group committee (31.4%), neighbourhood committee (27.9%) church committee (26.8%) and school committee (21.2%). Membership to groups tended to increase with age and level of formal education. Most of the respondents were also involved in the decision-making processes of their groups either as committee members (29.5%) or leaders (22.8%).

Half of the respondents (50.4%) had up to five friends whom they can share private matters and whom they can turn to when in need of help without getting disappointed. The proportion of respondents with 6 – 10 close friends was high for Sahiwal adopters (26.6%) compared to non-adopters (12.2%).

The level of social solidarity among respondents seemed moderate as only a third indicated that most of the people in their neighbourhoods can be trusted (36.2%) and were willing to help when one needed help (39.7%). Three-quarters (75.5%) of non-adopter respondents had higher scores on social solidarity as compared to slightly less than half of the adopters (48.8%).

In terms of trusting others, the study observed that respondents had great trust for their spiritual leaders (39.9%) and own age-group members but no trust for the police (48.8%), other Maasai sections (30.0%) and veterinary officers (24.4%). A larger proportion of adopters (59.6%) had below average level of solidarity compared to non-adopters (51.0%).
The frequency of helping others among the respondents depended on how closely they were to the respondent. Most respondents (82.8%) always helped their siblings, age-group members (30.3%) and own clan members (29.5%) but either rarely (46.4%) or never (24.5%) helped other tribes. Three-quarters of the respondents were willing to contribute own resources (time and money) towards community projects in their neighbourhood that did not benefit them but others. Adoption of Sahiwal cattle did not have any effect on the willingness of helping others among the respondents.

Three-quarters of the respondents listen to radios for news, information and entertainment but only 19.6 watch a television daily. A larger proportion of Sahiwal cattle adopters tended to watch TVs (4.0%) daily compared to non-adopters (2.0%). To know what the Government is doing respondents relied on radios, local markets as well as relatives, friends and neighbours. However, the order changes where respondents depend on relatives, friends and neighbours, local market and radios for the prices of milk and cattle.

In terms of interactions, the study found out that few respondents interacted with places beyond their local market centres and that adoption of Sahiwal cattle did not have any effect on the level of respondents’ interaction. The same was also true for sociability. However, adopters tended to experience theft of property more than non-adopters. A third of the respondents (32.7%) reported having total control over decisions that affect their daily lives and a high majority (97.1%) participated in elections.

IV. ASSOCIATION BETWEEN ADOPTION OF SAHIWAL CATTLE AND HOUSEHOLD SOCIAL CAPITAL

The two variables - adoption of Sahiwal cattle and household social capital were at the ordinal level of measurement. Thus, the appropriate test statistic for their association was Spearman’s rho. Using IBM SPSS (version 26) for the test, this study obtained results as indicated in Table 2.

Table 2: Correlation between adoption of Sahiwal cattle and social capital

<table>
<thead>
<tr>
<th>Spearman’s rho</th>
<th>Adoption of Sahiwal cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social capital</td>
<td></td>
</tr>
<tr>
<td>score</td>
<td>Correlation Coefficient</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed)  ** Correlation is significant at the 0.01 level (2-tailed)

As indicated in Table 2 indicates the correlation coefficient between the adoption of Sahiwal cattle and social capital was $r_s = -.017$ but not significant at the 0.05 level. The association was also negative and weak. Since the calculated p-value of -.749 was more than the $\alpha = .05$, the study accepted the null hypothesis that adoption of Sahiwal cattle among Isiria Maasai is not associated with household social capital.

The study further tested for the association between adoption of Sahiwal cattle and the ten aspects of social capital. Results showed that there were significant relationships with the aspects of solidarity, information and communication, safety as well as empowerment and political action. The information is presented in Table 3.

Table 3: Correlation between adoption of Sahiwal cattle and ten aspects of social capital

<table>
<thead>
<tr>
<th>Spearman’s rho</th>
<th>Adoption of Sahiwal cattle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correlation Coefficient</td>
</tr>
<tr>
<td></td>
<td>Sig. (2-tailed)</td>
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<td></td>
<td>N</td>
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<td></td>
<td>Correlation Coefficient</td>
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<td>Sig. (2-tailed)</td>
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<tr>
<td></td>
<td>Correlation Coefficient</td>
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<td></td>
<td>Sig. (2-tailed)</td>
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<td>Correlation Coefficient</td>
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<tr>
<td></td>
<td>Sig. (2-tailed)</td>
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<tr>
<td></td>
<td>N</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed)  ** Correlation is significant at the 0.01 level (2-tailed)

Table 3 shows that the associations were positive and weak for the social capital aspects of information and communication as well as empowerment and political action but negative and weak for solidarity and safety. There was no significant relationship between adoption of Sahiwal cattle and six aspects of social capital – membership to groups, friends, trusting others, helping others, interactions and sociability.

V. DISCUSSION

The rate of Sahiwal cattle adoption were in line with the assumptions of the Diffusion of Innovations theory which proposed that overtime adoption of an innovation occurs in stages throughout the social system [20]. The innovation of Sahiwal cattle introduced by the Transmara Development Programme in 1995 was in its final stage of adoption as the 13% of the respondents yet to adopt Sahiwal cattle were the laggards.

Studies on the level/strength of social capital and adoption of improved cattle breeds were scant. Among them was a study undertaken in Sulawesi in Indonesia [21]. The study observed that social capital among the beef farmers who had adopted improved beef cattle breeds was high. This finding differed with those of the current study which found that majority of the respondents had a moderate/medium level of social capital. Two factors may have caused the discrepancy of the result. In assessing the level of social capital among Isiria Maasai, the study took into consideration ten dimensions of social capital compared to only three considered by the Indonesian study. It was also probable that the divergence emanated from the observation that the Indonesian study was on improved beef cattle strictly distributed through farmer groups while Sahiwal
cattle adopted by Isiria Maasai were dual-purpose and there were no restrictions of accessing them via membership to groups.

Studies that tested the association between adoption of technology and social capital were mainly on crop production. [22] showed that there was a positive and significant relationship between adoption of agricultural production technologies and three aspects of social capital – group involvement (r=0.539), social support (r=0.312) and social networks (r=0.29). [23] also found a positive relationship between adoption of rice intensification technologies and participation of farmers in cooperative societies. The same results were also obtained in China by [24] and in Kenya by [25].

The variation in the outcomes was likely to be due to differences in the conception of social capital. This study conceived social capital as a livelihood outcome of technology adoption while the other studies considered it a facilitating process of adoption. It is also possible that differences in the dimensions of social capital studied may have also contributed to the differentiation of the results.

VI. CONCLUSION

From the findings, this study concludes that whereas there may not be an association between adoption of improved cattle breeds and the overall household social capital, it may be possible that an association exists with its dimensions. Specifically, it increases the number of friends but weakens a household’s level of safety, social solidarity and trust with others. Adoption of improved cattle does not affect the willingness to help others.

REFERENCES


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Health Assessment of Academicians through Body Mass Index Evaluation and Relationship with Strain

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Abstract- In the Aviation Field, safety is important and numerous steps had been taken to alleviate safety or retain it. The graduates from aviation institutions were trained to be efficient, skillful, and knowledgeable so that mistakes during jobs could be minimized or maintained at zero. In order for these graduates to have those characteristics, their lecturers or academicians should be at their bests in order to train these graduate efficiently. Being at their bests require the lecturers to be fit and healthy. We had investigated the health and fitness of these academicians and the results varies.

Index Terms- Health Assessment, Fitness in Aviation, Body Mass Index, Strain

I. INTRODUCTION

It is no secret that aviation is highly regulated and procedures needed to be adhered in a strict manner. This is to retain safety at its highest standard and also to minimize loss in terms of resources and lives. According to Ausrotas, aviation is intricate and to maintain safety one has to manage numerous aspects or factors [1]. Ausrotas stated that safety was the primary reason for procedures to be in place and these procedures ensured incidents or accidents were kept low [1]. With this in mind, its imperative for us to evaluate the fitness or health of academicians or lecturers of an aviation institute. Lecturers that are fit are able to effectively train graduates to be efficient in their jobs and graduates which are efficient are inherently skillful and knowledgeable and these characteristics would retain or increase the safety of the ecosystem. We had evaluated the health and fitness of academicians from a designated department at Universiti Kuala Lumpur Malaysian Institute of Aviation Technology (UniKL MIAT). UniKL MIAT is an institution located in Malaysia and had produced graduates in the field of Aviation.

Janic had spelled out several risks that were inherent in aviation and he indicated that it’s important to retain safety in lieu with all these risks [2]. Janic had quantified several risks and we had followed suit where we deemed those with health or fitness predicaments to be parlaying risks toward the aviation ecosystem.

We had evaluated the fitness and health of our subjects via Body Mass Index (BMI). We then captured the subject’s strain via interview. A question was asked whether they were strained when walking or strolling around campus. The strain data were then mapped with their respective BMIs. Nuttall had stipulated that excessive BMIs are not healthy to individuals and these excessive values would decrease their fitness and hamper their abilities to perform at their workplaces [3]. Nuttall also said the values of BMI were also used to define the policies of health of certain ministries where the policies were there to promote healthy BMI among the masses [3]. Dohle agreed with the notion of unhealthy BMI and stated that BMIs which were high or unhealthy are dangerous in the sense that the individuals would be at more risk to gain various diseases [4]. Dohle also pointed out that unhealthy BMIs showed correlations with mortality where it’s important for one to be vigilant of their BMI value in order to mitigate mortality [4].

Harridon had studied fitness predicaments among crews of Search and Rescue and he pointed out that crews that were equipped with appropriate experiences (due to numerous training and implementation) were able to maintain their fitness level and health [5]. This showed that educating the masses is a good way to equip them with the necessary tools to maintain their BMI at healthy levels.

The unhealthy BMI posed a threat where the excessive weight would lead to strain upon the legs of the individuals. Howitt had stated that those with excessive weights would induce strains upon their legs since the legs were carrying more loads and were constantly being barraged with these loads daily [6]. Howitt also explained that the overused of these legs contributed to pain and discomfort among individuals [6].

Harrington had studied excessive weights upon legs and concluded that these weights had affected the legs and strains were produced due to this [7]. Harrington had also indicated in some cases the excessive weights had contributed to pains in the knees of the individuals [7]. These overlaying facts had prompted us to dwell upon this research and our evaluation of the BMIs of the academicians were justified.

II. LITERATURE REVIEW

As mentioned before, safety is uttermost important in aviation and all parties should be physically fit to perform at their bests. Oster mentioned that safety had improved tremendously in recent years and this was due to comprehensive incident or accident analyses where these analyses had pinpointed the reasons behind incidents and accidents [8]. One of the reason was human factor where personnel in aviation were not performing effectively due to unfit physical forms. This is where...
our research came in where we assessed those involved in aviation in terms of health and physical fitness.

Bala had studied literature pertaining to Aviation Safety and he had classified several factors that contributed to Aviation Safety [9]. Interestingly human factors did play roles as contributors toward Aviation Safety where those with optimum fitness were prone to enhance the safety of the aviation environment [9].

Stenholm had studied subjects in 4 European countries and results had indicated that those with excess BMI were not healthy and were inclined to gain various health problems [10]. Stenholm had listed heart failure as one of the unhealthy components of excessive BMI and Stenholm had advocated for the introduction of programmes to reduce the values of BMIs among those that showed unhealthy BMIs [10].

Ezzati stipulated that most diseases were due to surpluses of fats that were etched upon individuals and these surpluses translated into high values of BMIs [11]. Ezzati mentioned that being overweight is not healthy and the propensity to be not fit is high [11]. This of course is detrimental to the aviation industry as the industry requires instructors or lecturers that are fit where instructors that are fit can mould the students efficiently.

Harridon had spelled out several appropriate methods that could be utilized in order to reduce the BMI values [12]. Harridon had actuated research upon aviation workers and Harridon had proposed High Intensity Interval Training (HIIT) to aviation personnel in order to reduce their excessive BMIs [12]. Furthermore, Harridon had also laid out 2 exercises, which were Squats and Step-Ups, that could strengthen the legs of individuals and subsequently eradicate or minimize strain [12].

As mentioned before, those with excessive weights would be imparted with strains especially at their legs. Wollesen ascertained that loads and weights were the culprits that induced strains upon individuals [13]. Wollosen had scrummage through selected literature and had elucidated strains and mapped these to individuals that were studied [13]. There were consequently different degrees of strains that derived from different sets of chores or types of jobs actuated by the individuals [13].

Dixon noted that overused of the legs or extreme utilization of the legs would create strains in the legs [14]. We paraphrased this to be the overloading of the legs through additional body weight and this extra weight has subsequently be a detriment to the movements of the individuals. We cautioned academicians to take note of this as they are in constant movements around campus, moving from classes to classes and also moving to attend lab sessions or meetings. We can observed that our study is important where we had identified academicians that were in need of direction in terms of actuating physical fitness regime in order to gain a healthy BMI.

III. METHODOLOGY

Figure 1 showed our approach for this research.

![Figure 1. The Methodology that was Utilized](image-url)

The Aviation Management Department of UniKL MIAT was chosen for our study. The academicians in this department were assessed pursuant to their health and fitness. The minimum required number of respondents or subjects from this department was calculated using Sample Size Equation. The following values were inserted into the equation: population size = 11, confidence level = 80%, and margin of error = 9.55%. We obtained the value 9 for the minimum required number of subjects and we had successfully obtained data from 9 subjects or academicians.

Data of gender, age, height, and weight were collected from the respondents and these data were tabulated which gave us a proper display and gave us ease for analyses. The Body Mass Index of each academician in our study was calculated by using the BMI Equation where data of height and weight of each
respondent were inserted into this equation. The BMI of each respondents was then classified in accordance to Table 1. Each classification was then represented graphically in order to gain or display the number of academicians in each category or class.

The respondents were posed a question with regards to the strains they encountered while walking or strolling around campus. The “yes or no” answers (strain data) were tabulated along with other previous data. The strain data were also mapped against the BMI classes of each respondents and these mappings were represented in a pie graph. The results that we gained were analyzed, discussed, and concluded.

Table 1. Body Mass Index Classification for Males and Females [15]

<table>
<thead>
<tr>
<th>Body Mass Index (Males &amp; Females) (kg/m²)</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5 - 24.9</td>
<td>Normal or Healthy Weight</td>
</tr>
<tr>
<td>25.0 - 29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>30.0 and Above</td>
<td>Obese</td>
</tr>
</tbody>
</table>

IV. RESULTS

Table 2, Table 3, Figure 2, Table 4, and Figure 3 showed the results of our research.

Table 2. Body Mass Index Classification of Male Respondents

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Gender</th>
<th>Age</th>
<th>Height (m)</th>
<th>Weight (kg)</th>
<th>Body Mass Index (kg/m²)</th>
<th>Body Mass Index Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent1</td>
<td>Male</td>
<td>43</td>
<td>1.75</td>
<td>84</td>
<td>27.4</td>
<td>Overweight</td>
</tr>
<tr>
<td>Respondent2</td>
<td>Male</td>
<td>69</td>
<td>1.70</td>
<td>72</td>
<td>24.9</td>
<td>Normal or Healthy Weight</td>
</tr>
<tr>
<td>Respondent3</td>
<td>Male</td>
<td>34</td>
<td>1.70</td>
<td>85</td>
<td>29.4</td>
<td>Overweight</td>
</tr>
<tr>
<td>Respondent4</td>
<td>Male</td>
<td>59</td>
<td>1.70</td>
<td>72</td>
<td>24.9</td>
<td>Normal or Healthy Weight</td>
</tr>
<tr>
<td>Respondent5</td>
<td>Male</td>
<td>66</td>
<td>1.85</td>
<td>90</td>
<td>26.3</td>
<td>Overweight</td>
</tr>
</tbody>
</table>

Table 3. Body Mass Index Classification of Female Respondents

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Gender</th>
<th>Age</th>
<th>Height (m)</th>
<th>Weight (kg)</th>
<th>Body Mass Index (kg/m²)</th>
<th>Body Mass Index Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondent6</td>
<td>Female</td>
<td>24</td>
<td>1.70</td>
<td>72</td>
<td>24.9</td>
<td>Normal or Healthy Weight</td>
</tr>
<tr>
<td>Respondent7</td>
<td>Female</td>
<td>38.5</td>
<td>Obese</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent8</td>
<td>Female</td>
<td>24.5</td>
<td>Normal or Healthy Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent9</td>
<td>Female</td>
<td>31.2</td>
<td>Obese</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
V. DISCUSSION

Table 2 showed the tabulated data of gender, age, height, and weight for males. It also showed the calculated BMI for each male respondent and the BMI classification as well. Two of the male respondents were healthy while three male respondents were overweight. We were concerned about this figure as the three male respondents represented the majority of male respondents. In fact the two male respondents that were healthy in actuality were borderline healthy and their BMIs almost reached the threshold of overweight. Hence we opined that all 5 male respondents should be integrated into a physical fitness programme or training.

Harridon had indicated that some quarters of professionals in aviation, especially those involved in Aviation Search and Rescue, had gone through extensive training in order to perform well during work [16]. Harridon stipulated that these training were not only in the fields of their expertise but also in the physical fitness realms as those equipped with this type of training were familiar with the methods or ways to improve their physical being and subsequently their performance during work [16].

Table 3 showed the data for the female respondents. The gender, age, height, and weight represented these data. Table 3 also showed the BMI of each female respondents along with their classifications. 50% of the female respondents were normal while 50% of them were obese. This situation is grave and we proposed an immediate initialization of a physical fitness programme which would gradually decrease the BMIs of these respondents. As stated before, the chances of contracting diseases are high with the advent of unhealthy BMI and hence we were overly concerned.

Figure 2 parlayed the classifications of the Body Mass Index and the number of academicians (males and females) in each class. The greatest number of academicians was in the Normal or Healthy Weight Class. This is promising and showed a majority of the respondents were taking care of their health and fitness. But it was alarming to observe 2 respondents in the Obese Class and 3 respondents in the Overweight Class. Collectively they represented a big chunk of the academicians. This reinforced our prescription to initiate a physical fitness programme at the campus.

Table 4 gave us a view of the strain data. Four academicians had not felt any strain while walking or strolling around campus while five academicians felt the strain. This is worrisome as a majority of the academicians felt strained while strolling the campus. Strolling the campus is part of their job as they need to be at numerous places in campus to deliver lectures, attend meetings, and others. Peering discreetly, 3 out of 4 female academicians felt strained while walking and 2 out of 5 male academicians felt strained while walking. 75% of female academicians felt the strain while walking and this is quite high and alarming.

We were interested to know the number or percentage of academicians that were strained because of their excessive or unhealthy BMIs. Figure 3 showed the mapping of the strain data against classes of BMI. 2 academicians were strained because of unhealthy BMIs while 3 academicians were strained not because of unhealthy BMIs. Investigating further, we found out that these 3 academicians were actually having BMIs that were almost unhealthy (24.0 till 24.9) and hence which explained why they felt strained while walking in campus. This strengthen our decision in prescribing physical exercises for the academicians and validated our gist of assessing personnel in the aviation field.

Harridon had assessed the physical fitness of Aviation Personnel at an aviation company in Malaysia and through this assessment several personnel were identified as being unfit and it was proposed to them to expedite their physical exercise regime [17]. Harridon mentioned that their physical forms should be constantly monitored as to maintain the integrity of aviation safety [17]. Our gist is similar to Harridon as there is always the need to assess individuals that worked in the aviation field since safety is paramount and important.

VI. CONCLUSIONS

Our assessment had unearthed vital information regarding the health and fitness of academicians in the aviation field. A majority of our respondents were ingrained with unhealthy BMIs and this increases their risks of gaining harmful diseases. Our results also indicated that a majority of the academicians had felt strained while walking or strolling around campus in order to attend meetings, delivering lectures, and performing other academic tasks. We had provided several measures to decrease the BMIs of the academicians and numerous literature were parlayed to mould the academicians to be fit and healthy. This is inline with the philosophy of aviation where a fit worker is not prone to mistake and thus safety is retain or increase.

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Prevalence And Risk Factors Of Work-Related Musculoskeletal Disorders Among Housewives

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Abstract- Background: Housewives consist of a large population in Malaysian society. To date, there is no data baseline on the prevalence and risk factors of work-related musculoskeletal disorders among housewife in Malaysia

Aim: To determine the prevalence and risk factors of work-related musculoskeletal disorders among housewives in Selangor, Malaysia.

Methods: A modified questionnaire of study of Golam (2015), Perceived Stress Scale and Nordic Questionnaire was used to determine prevalence, site of work-related musculoskeletal disorders and potential risk factors for work-related musculoskeletal disorders among housewives in the past 12 months. The setting was targeted the housewives in Selangor, Malaysia.

Results: The study shows 75% of prevalence of work-related musculoskeletal disorders among housewives in Selangor, Malaysia. The most common site of work-related musculoskeletal disorder among housewives was lower back, knee and foot/ankle region. The common site that prevented their normal work was shoulder, knee and neck region. The potential risk factors that was to be found associated with work-related musculoskeletal disorders was age (p=0.015), duration of household activities (p<0.001), exercise (p<0.001) and duration of exercise (p=0.002). Physical factors like repetitive movement, awkward posture, heavy lifting and prolonged activity with insufficient of rest period were found to be related with work-related musculoskeletal disorders among housewives. There was no significant association in work-related musculoskeletal disorders regarding ethnicity, education level obtained, number of children, types of household activities, domestic helps and stress level among housewives.

Conclusion: The prevalence of work related musculoskeletal disorders among housewives is as high compared to other occupations. Awareness and medical attention for housewives regarding work related musculoskeletal disorders must be highly concerned and emphasized. The potential risk factors should be highly avoided to scale down the risk of work-related musculoskeletal disorders.

Index Terms- Prevalence, risk factors, work-related musculoskeletal disorders, housewives

I. INTRODUCTION

1.1 Background of Study

Housewives consist of a large population in Malaysian society and housewifery is known as an occupation in the country. Housewife is a women who manages the household as her main occupation. A housewife is a women that employed her main occupation as taking care and managing her home, educating her children, perform cooking and storing goods, washing and cleaning of the housing area, washing and ironing clothes for the family, buying grocery for the needs of the family (Suvarna & Tulika, 2017).

Full-time housewives tend to involve more in all households compared to part-time housewives (Yuhaniz & Junus, 2016). Full-time housewives who involved themselves fully in...
household activity will be more precise in investigating the prevalence and risk factors of work-related musculoskeletal disorders among housewives. Part-time housewives who have others occupation might alter the result of a study. Those household activities performed by full-time housewives are almost utilized of their hands, arms and legs (Dhone & Khare, 2017). Therefore, there is more incidence of suffering work-related musculoskeletal disorders.

According to the report of Fifth Malaysian Population and Family Survey [MPFS-5] 2014 by the National Population and Family Development Board (LPPKN), among married women aged 15-59 years, there were 46.5 % who were working, 53.5 % who have stopped working and never worked. These figures show that stay-at-home mothers still comprise of a great significant segment of the general public and they required more attention from society. Those full-time stay at home mothers reported to perform the household activities every day and taking care of their family members, especially their children.

A study showed that women perform 54% more household activities compare to men (Horne, Johnson, Galambos, & Krahn, 2018). This is because of the division of household labor literature by disengaging the prescient power of time, resources and gender perspectives on housework at particular life stages. Moreno-Colom (2017) also found that women spend more of their time on housework activities which approximately 3 times the number of hours on routine household activities compared to men. Women who work for high household hours are more likely to report decreased physical health (Thomas et al., 2018).

According to the World Health Organization (WHO), the term work-related musculoskeletal disorders (WMSDs) describes as musculoskeletal disorders which is supposed to be caused by any occupation. The role of housewives for taking care of all family members and household activities is considered as an occupation. The work-related musculoskeletal disorders could affect different parts of the body like neck, shoulder, elbow, wrist, hand, upper back, lower back, thigh, knee and feet. Most of the work-related musculoskeletal disorders develop over time. The duration of work-related musculoskeletal disorders can be categorized into anecdotal and continual. Work-related musculoskeletal disorders can be the consequences of injury sustained in a work-related accident. Work-related musculoskeletal disorders are seldom a life-threatening disorders. However, they can affect the quality of life of a large proportion of working adult population (Health and Safety Executive, 2017).

Housewives having high risk to suffer various problems which related to their occupations that cause injuries to their muscles and skeletal system. Suvarna and Tulika (2017) proven that housewives have more incidence of suffering work-related musculoskeletal disorders. Those work-related musculoskeletal disorders are related with a group of painful disorders of muscles, tendons and nerves. Work-related musculoskeletal disorders are also one of the major factors which related to increased compensation and health costs, reduced productivity of work and lower quality of life (Yan et al., 2017). In addition, work-related musculoskeletal disorders can progress from mild to severe disorders. Thus, early treatment must be taken from mild disorders in order to avoid deterioration of the condition.

Work-related musculoskeletal disorders are associated with work patterns that including constrained body positions, the continual repetition of movements, force concentrated and no sufficient recovery period between activities (Moreno-Colom, 2017). Work-related musculoskeletal disorders can develop in an occupational setting. This is due to the physical tasks which an individual carry out during their normal work activities. Household activities that performed by housewives are included in the associated work pattern of work-related musculoskeletal disorders. Therefore, housewives having higher chances to suffer from work-related musculoskeletal disorders.

The study of Suthar & Kaushik (2011) supported that 76.66% of women reported neck pain and 46.66% of women reported shoulder pain. The reported work-related musculoskeletal disorders was because of performed all the activities in an awkward posture and prolonged duration without sufficient rest period. 76.66% of women also reported back pain and their long term work activities were engaged in standing and bending postures. A total of 46.66% women
reported pain in the upper arm due to the static position of hands and onset of fatigue in upper arm muscles during their work.

Another study done by A.R. Anita et al. (2014) indicated that awkward posture was related to work-related musculoskeletal disorders. Workers that having 87.0% of high and 97.2% of very high Rapid Upper Limb Assessment (RULA) risk level are reported to suffer from musculoskeletal disorders. The awkward posture of housewives during household activities would increase the RULA risk level. Housewives who perform a multitude of tasks from household activities that will cause physical stress as well as exhaustion of muscle groups that result of work-related musculoskeletal disorders (Hossain et al., 2018).

Besides than physical factors, a literature review and epidemiological studies have shown that there are other two sets of risk factors can be considered in the genesis of the work-related musculoskeletal disorder (Nunes & Bush, 2011). Firstly, individual factors including age, ethnicity, household activities, sports activities, domestic activities, recreational activities, alcohols, and tobacco consumption. Those suggested individual factors are related to work-related musculoskeletal disorders (Bruno & Edgar, 2010). Next, psychosocial factors that could cause work-related musculoskeletal disorders are the work pace, stress level, rest cycle, task demands, and social support. Bruno & Edgar (2010) also suggested that the identified psychosocial risk factor of work-related musculoskeletal disorders was a high level of distress. Thus, all kind of factors that caused work-related musculoskeletal disorders among housewives should be investigated to determine the association between them.

In 2016, the Institute for Health Metrics and Evaluation of Malaysia shows that the top causes of years lived with disability are low back and neck pain. It also shows that there is 37.6% increase from the year 2005 to 2016. Work-related musculoskeletal disorder is one of the most common occupational diseases which mainly affects the lower back and neck (Hossain et al., 2018). Many studies have shown that high prevalence (31% to 100%) of work-related musculoskeletal disorder among housewives (Kalra & Bhatnagar, 2017; Sallehuddin et al., 2018).

Regarding the site of work-related musculoskeletal disorders, there were several research studied about the different body parts among housewives. Study of Gupta & Nandini (2015) supported that 83% of 301 non-working rural housewives have low back pain and 51.5% of them had a severe disability. Suthar & Kaushik (2011) also supported that 76.66% of 30 women reported neck pain and 43.33% among them suffer severe pain of neck. Low back pain and neck pain have a high prevalence in housewives compare to other parts of the body.

This study would able to find out the prevalence and risk factors of work-related musculoskeletal disorders among housewives. The most frequent body parts that encounter work-related musculoskeletal disorders will also be investigated. The results from this study would contribute an insight regarding the sustained work-related musculoskeletal disorder. This study will also enable future researchers to evaluate better prevention and treatment in treating work-related musculoskeletal disorders among housewives.

1.2 Research Objectives
The objectives of this study was to:

1. To determine the prevalence of work-related musculoskeletal disorders among housewives.
2. To determine the most common site of work-related musculoskeletal disorders among housewives.
3. To determine the risk factors of work-related musculoskeletal disorders among housewives.

1.3 Research Questions
1. What is the prevalence of work-related musculoskeletal disorder among housewives?
2. Which is the common site of work-related musculoskeletal disorder among housewives?
3. What are the risk factors for work-related musculoskeletal disorder among housewives?
1.4 Operational Definition

**Prevalence:**
Prevalence is a statistical concept referring to the number of cases of a disease that are present in a particular population at a given time.

\[
\text{Prevalence} = \frac{\text{Number of Participants reporting any form of problem}}{\text{Number of questionnaire respondents}}
\]

**Work-related Musculoskeletal disorder:**
Work-related musculoskeletal disorders are musculoskeletal disorders which are caused by occupation. Musculoskeletal disorders are health problem that affect the muscle, skeleton, ligament, tendon and cartilage.

**Risk Factor:**
Risk factor is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury.

**Housewives:**
Housewife is a women who manages the household as her main occupation and whose spouse usually earns the family income.

1.5 Rationale and Scope of Study

According to Social Security Organisation’s (SOCSO) statistics, National Institute of Occupational Safety and Health (NIOSH) in 2013 alone, there were 694 ergonomics related cases out of 2,630 cases of disease in Malaysia. This means that for every four cases reported to SOCSO, there will be one case is related to work-related musculoskeletal disorders (Borneo Post Online, 2017). Work-related musculoskeletal disorders cases are common in Malaysia, however, occupation like housewife is not emphasized.

Many studies concluded that the high prevalence of work-related musculoskeletal disorder is found among housewives (M. M. Habib & Rahman, 2015; Kalra & Bhatnagar, 2017). They are having a high risk of encounter one or more work-related musculoskeletal disorders which can progress to affect their quality of life (Moreno-Colom, 2017). Thus, the prevalence of work-related musculoskeletal disorders among housewives in Selangor, Malaysia should be determined. In addition, work-related musculoskeletal disorders among the population of housewives should be highly concerned to increase awareness and prevention.

Moreover, different studies have shown a different kind of prevalence, site of disorders and risk factor among housewives in a different area. Thus, those studies might not be able to generalize all of the housewife in Selangor, Malaysia. It might due to different culture and environment of different country that generate different result of a study. An independent study in Selangor, Malaysia should be done to clarify the prevalence and risk factors of work-related musculoskeletal disorders among housewives.

To date, there is no data baseline on the prevalence of work-related musculoskeletal disorders among housewife in Malaysia yet. Hence, the purpose of this study is to determine the prevalence of work-related musculoskeletal disorders among housewife. The study will be including the site of disorder and risk identification which including individual, physical and psychosocial risk factor. It is important to understand the potential risk factors of work-related musculoskeletal disorders among housewife. So that, it helps to raise awareness and prevention among the housewives.

This study focuses on the prevalence and risk factor of work-related musculoskeletal disorder among housewives in Selangor. The site of work-related musculoskeletal disorder will also be determined in this study. The questionnaire used is adapted from the questionnaire from the study of Golam (2012), the Nordic Questionnaire and the Perceived Stress Scale.
II. LITERATURE REVIEW

2.1 Risk Factors of Work-related musculoskeletal disorders

A research was conducted by Macdonald and Oakman (2015) to discuss the exposures of occupational towards workers’ risk of developing musculoskeletal disorders (MSDs). Authors indicated that occupational hazards increase the musculoskeletal disorders among the workers. Based on the review of research evidence, National Academy Press (2001) reported the risks of work-related musculoskeletal are external loads, organizational factors and social context. Work-related musculoskeletal disorders risk from various hazards associated with the physical factors. The physical requirements of work performance is often referred to manual handling activities. However, according to European Framework for Psychosocial Risk Management, psychosocial risk factors including the hazards related to job content, workload and work pace, work schedule, organizational culture and function, career development, role in an organization, interpersonal relationships at work, and home-work interface. Lang and colleagues (2012) also confirmed that the relationship between workplace psychosocial risk factors and musculoskeletal disorders.

A journal from Kim (2015) with the title of Ergonomics and Musculoskeletal Disorders supported that work-related musculoskeletal disorders are one of the leading types of occupational injury. Those work-related musculoskeletal disorders provoke the greatest costs to workers’ compensation. The consequences of any body parts of work-related musculoskeletal disorders could be long term and can affect every aspect of a worker’s life. The source of work-related musculoskeletal disorders development is repetitive, vigorous and awkward movements on body parts of bones, joints, ligaments and other soft tissues. Work-related musculoskeletal disorders always a leading source of disability and affect the productivity of workers in the workplaces.

In 2013, a study was conducted by Bugjska et al. to specifically determine the relationship between psychosocial work conditions and musculoskeletal complaint (MSc). 725 employees with any kind of occupation were targeted in this study. Authors claimed that these issues are rarely precisely discussed in the literature on rheumatology. Employees that performing mental work have increase of musculoskeletal complaints. The reading influenced authors to explore more about the working surroundings for the root of musculoskeletal complaints apart from physical factors. As result, the study has shown that there was an alliance effect of psychosocial and physical factors toward musculoskeletal complaints. In addition, the study concluded that there is adversity to speculate the effect of psychosocial factors on musculoskeletal disorders. This is because there were various ways in identifying the psychosocial attribute of a job and there was different appliance used to measure the psychosocial level.

2.2 Prevalence and Risk Factor of Work-related Musculoskeletal disorders among housewives

In 2018, Sallehuddin et al. (2018) aim to assess the variation in body pain among overweight and obese Malaysian housewives. The musculoskeletal pain (MSP) that determined was according to the site and severity of injured body regions. The study indicated that overweight and obese considered as a high-risk group for getting musculoskeletal pain. Moreover, they suggested that older obese housewife had a higher risk of getting musculoskeletal disorders to compare to a young obese housewife. The number of painful areas and level of pain also increased with obesity level of housewives. The amount of force on a weight bearing joint is found to be increased with excess weight of a person. Among middle age and elderly housewives, finding shows increasing of weight will cause shoulder, heel and hip pain. Another study supported that 31% of 495 housewives who suffered from musculoskeletal pain are having a higher body mass index (Bihari et al., 2013). As weight and age are the risk factors for work-related musculoskeletal disorders, others potential risk factor should be clarified among housewives in Malaysia.

Kalra & Bhatnagar (2017) aims to investigate the prevalence of musculoskeletal disorders (MSDs) of housewives in Delhi and Noida. 100 housewives which aged 25-35 years with no pregnancy were selected to participate in the study. The study indicated that 100 % housewife were affected by musculoskeletal disorders in one or more body region. Housewives suffer pain with lower back (60%), shoulder (42 %), upper back (38%), neck (35%), wrist/ hand (29%), ankle/ feet (26%), knee & thigh/ hips/ buttocks (20%) and elbow (18 %) were prevented from
perform their normal activities. The high prevalence of musculoskeletal disorders among housewives suggests that housework could be an independent risk factor that caused to develop musculoskeletal disorders among housewives. Another reason could be due to some physical stress and features of household activities such as taking care of family members, cooking for meals and cleaning at home. There were several relevant literature review findings found that musculoskeletal disorders likely increased with increasing the duration of performing household activities at home. Besides, low back disorders were found to be corresponded to perform daily household activities, like frequent lifting of objects or children whom heavier than 10 kg. However, the analysis data of risk factor were not stated and discussed in the study. A clear discussion of the risk factor of musculoskeletal disorder should be stated in the study.

There was a study conducted by Dhone and Khare (2017) in Nagpur City, Maharashtra to evaluate musculoskeletal disorders among the housewives. A total number of 100 housewives whom regularly performing household activities such as preparation of food, cooking, cleaning home, dishwashing were targeted. However, the study was only limited to the housewives who aged 40 to 50 years. The working capacity of the housewives is determined by the daily household activities. The musculoskeletal disorder among housewives is determined by the type of household activities which they are performing. 60% of the housewives were having musculoskeletal disorders due to awkward working posture while performing household activities. It also found that about 15% of housewives were suffering from muscles stress due to continuously performing the same household activities without taking proper rest. Lower back and upper extremity were the most common site among housewives because of physical stress factors and individual risk. It was found that wrong working methods will cause housewives to face ergonomic problems which leads to musculoskeletal disorders.

Habib & Rahman (2015) had investigated the prevalence of frequently affected body parts among women who experienced musculoskeletal symptoms (MSS). Throughout the study, musculoskeletal symptoms which disturb the normal daily activities of women were determined. The objective of the study was to find the correlation of musculoskeletal symptoms with physical risk factors among women engaging in regular household activities. The researchers recruited 73 women aged 20 to 45 years who were involved in household activities for at least 5 hours per day for the past year. It was found that in the 12 months prior to the study, the upper back was the most frequently affected body region causing musculoskeletal symptoms followed by lower back, knees, neck, wrists, elbows, shoulders and ankles. Participants with lower back region musculoskeletal symptoms were associated with the awkward posture of the back while regular daily activities of household for prolonged periods of time. The prevalence rate of self-reported musculoskeletal symptoms among the respondents was found to be considerably high (68.49%). The physical risk factors are particularly awkward posture, bending, repetitive movement and lifting during perform household activities. Those physical risk factors were associated for musculoskeletal symptoms in different body parts of women. However, the findings of this study are just a snapshot of the women engaged in regular household activities of one small village in Bangladesh. There is considered a big limitation for generalizability of the findings.

In 2015, Mishra, Srivastava, and Srivastava did a study regarding musculoskeletal pain in rural homemakers of North India. This study purposes to determine the magnitude of musculoskeletal pain among rural homemakers and to identify its modifiable risk factors. 296 homemakers who aged 26 to 65 years have participated in the study. 40.9% of homemakers reported having musculoskeletal pain. The most common site for MSP was found to be ankles/feet (29.53%) followed by knees (25.59%) and low back (21.26%). This study had identified risk factors of musculoskeletal pain among homemakers. Individual factors which included of age, parity, income, and tobacco chewing were determined. The finding shows that neck and shoulder problems more encountered among women with children compared to women with no children. This might due to the increase of workloads in parental care. Being overweight or obese puts extra weight on muscles and joints, thus caused increases of musculoskeletal pain. However, there is no study about prevalence of musculoskeletal pain among housewives done in Malaysia within years.

In 2014, a cross-sectional study (N=600 housewives, aged 20-65 years old) was done by Fazli et al. in Iran to examine the prevalence of musculoskeletal disorders and its predictors among housewives. The study result showed that 53% of housewives suffering from
musculoskeletal disorders. The greatest prevalence of musculoskeletal disorders was found to be in the back region (51.33%), followed by neck (51%) and shoulder (41.5%) and least at wrist (40.5%). This study suggests that the prevalence of pain and disorders increase with several individual factors. Increasing of age, weight, height, married duration, number of children and with low educational level were related to musculoskeletal disorders. Musculoskeletal pain among housewives could have corresponded with awkward work postures and repetitive hand movements during perform household activities. The finding was supported with some literature discussing the working condition which related to musculoskeletal pain. However, the questions from the questionnaire do not clearly ask for the physical risk factor of the housewives. The types of household activities could be the physical risk factor of getting musculoskeletal disorders which should be clearly stated in the questionnaire.

Golam Kibria (2012) done a study to investigate the common site of musculoskeletal complaints among housewives. A number of 100 samples were selected as convenience sampling from Dhaka district Savar area. A mixed type of questionnaire was used to collect data. There were 84% of housewives suffered from musculoskeletal complaints. The most affected body part of musculoskeletal disorders was lower back (46%). Among the participants, 21% of them have taken physiotherapy treatment for their musculoskeletal disorders. The prognosis of physiotherapy treatment toward musculoskeletal disorders was 100% good reported from housewives. This study supported that work-related musculoskeletal disorders have great impact causing severe chronic pain. The physical disability of musculoskeletal disorders giving a rise to huge costs for compensation. In work place, housewives are susceptible to sustain musculoskeletal disorders during their work routine. Housewives suffer from multiple musculoskeletal problems that significantly blunt their activities of daily living. Further study was required to verify the consistency of findings and also to understand what factors contribute to these musculoskeletal complaints.

2.3 Prevalence of work-related musculoskeletal disorders among housewives in lower back region

In Sri Lanka, Ranasinghe P, Atukorala I and Samaranayake (2016) study the prevalence of household work-related musculoskeletal disorders (HWMSD) in low back region. 1102 housewives among 20 to 50 year old in an urban Sri Lankan participated. Participants were housewives whose perform household activities for a least of 4 hours per day and at least 5 days per week. Housewives whose are menopause, inflammatory arthritis, pregnant and having past disorders or problems that not related to household activities were not included in the study. The prevalence of household work-related musculoskeletal disorders in low back region among housewives was 36%. Most of housewives were performing various types of household activities like cooking, hand washing clothes, ironing, sweeping, cleaning toilets, shopping and carrying children. Household work-related musculoskeletal disorders in low back region were correlated with physical factors. As physical factors are shown related to the household activities, psychosocial factors and individual factors should also to be investigated to determine the correlation between household work-related musculoskeletal disorders. Other parts of body should be included to study the prevalence of household work-related musculoskeletal disorder among housewives.

Gupta & Nandini (2015) study to evaluate the prevalence of low back pain in non-working rural housewives and the impact of social burden on low back pain (LBP). A sample of 301 non-working rural housewives of Kanpur which aged between 30 and 70 years was selected. Analysis of data found that both recent and yearly prevalence of low back pain in rural housewives was 83%. The study also showed more than 50% housewives have a severe disability due to their low back pain. Prolonged duration of working hours without sufficient rest periods, poor posture, improper techniques of lifting and carrying loads also contribute to their back pain as physical factors. Effects of potential risk factors like family structure, socio-economic status and educational level of housewives and social burden should study a give a better understanding of the problem. Furthermore, lower back pain should not be the only musculoskeletal disorder that studies among housewives. Every part of the body that might have the probability in getting musculoskeletal disorder should be studied among housewives.
III. MATERIAL AND METHOD

3.1 Study Design
A cross-sectional study was used to conduct this research to determine the prevalence, risk factors and the most commonly injured body parts sustained from work-related musculoskeletal disorders among housewives. The duration of study was 4 weeks.

3.2 Ethical Approval
This study was performed after obtaining ethical approval by the Scientific and Ethical Review Committee (SERC) of Universiti Tunku Abdul Rahman (UTAR). Informed consent was obtained from the participants in the form of online or paper copy. In addition, the participants were notified of the confidentiality of the information given by them and the right to withdraw from the study at any given moment.

3.3 Population and Study Sample
In order to participate in this research, participant must be a full-time stay at home housewife who live in Selangor. Participants must be women who were aged between 18 to 50 years old. Last but not least, participants must at least being housewife for 1 year. Pregnant housewife and previous musculoskeletal complaint before being housewife of participants were excluded in the study.

3.4 Sampling method
Convenient sampling method was used.

3.4 Sample Size
The following is the formula to calculate the sample size for cross sectional study suggested by the researchers by Charan and Biswas (2013):

\[
\text{Sample size} = \frac{Z_{1-\alpha/2}^2 p(1-p)}{d^2}
\]

Where:
- \( Z_{1-\alpha/2} = 1.96 \) as in most of the studies P values are considered significant (less than 0.05)
- \( p \) = estimated proportion of characteristics based on previous studies (0.40)
- \( d \) = tolerated margin of error (5% is chosen)

Hence, the calculated sample size is 368.

3.5 Instrument
The modified questionnaire used was adapted from questionnaire from the study of Golam (2012), the Perceived Stress Scale (PSS) and the Nordic Questionnaire were used. Permission for modification of the questionnaire have been approved by the author of Golam (2012). The modified questionnaire is used to collect data on the prevalence, potential risk factor and site of disorders for work-related musculoskeletal disorders. The potential risk factors were obtained by using question from previous study (Golam, 2012) and Perceived Stress Scale. The site of disorders which work-related musculoskeletal disorders were obtained by using Nordic Questionnaire.

The questions of the modified questionnaire will be including of open-ended question and structured multiple choices options. There were 3 different languages version of modified questionnaire (English version, Chinese version and Malay version) for easy understanding.

The paper version of questionnaire consists of five pages. First page consists of information sheet of the study and consent form for the participants. Second page consists of 6 questions of socio-demographics characteristics of subject. The third and fourth page consist of 9 questions about the risk identifications of work-related musculoskeletal disorders and Perceived Stress Scale. The Perceived Stress Scale consists of 10 questions with the scale of 0 to 5. Lastly, the fifth page consists of identification of site of disorders, Nordic Questionnaire. The questions of Nordic Questionnaire consists of body parts like neck, shoulder, elbow, wrist/hand, upper back, lower back, hip/thigh, knee and feet/ankle.

The online version of modified questionnaire was created by Google Forms. The online version of modified questionnaire was uploaded at social media platform, Facebook for study recruitment. Participants who were interested, eligible and agreeable for the study were guided to click the link to complete the online version of modified questionnaire.
Both paper version and online version of modified questionnaire took approximately 3 to 5 minutes to complete.

The questionnaire consisted of 3 sections. Section A of the modified questionnaire was including the socio-demographic information. Section B was including the risk identification questions and Perceived Stress Scale. Section C was Nordic Questionnaire for identify site of disorders.

Section A was relevant to social-demographic and personal data of participant, consisting age, ethnicity, education level that obtained, occupation, duration of occupation and number of children. The questions of occupation and duration of occupation are used to clarify participant whom fits the inclusion criteria for the study.

Section B was pertained to the risk identification. It comprised of duration of working on household activities, types of household activities done, any help from domestic, type of work that domestic work help, types of exercise done, duration of exercise, acknowledgement of physiotherapy treatment and Perceived Stress Scale. The types of household activities consisted of sweeping, mopping, washing, cooking, parental care, grocery shopping and other option that need participant to specify their own. Types of exercise including walking, jogging, swimming, cycling, yoga and other option that need participant to specify their own. The Perceived Stress Scale (PSS) consisted of 10 questions with scale of 0 to 5. The scoring of Perceived Stress Scale is used to determine the stress level of participants.

Section C was the questions of Nordic Questionnaire. The questions including the site of participants that had any trouble in 12 months, during the last 7 days and prevented them from doing their normal work. The site of musculoskeletal symptoms are neck, shoulder, elbow, wrist/hand, upper back, lower back, hip/thigh, knee and foot/ankle.

3.6 Procedures
Researcher had distributed the questionnaires to participants in the area of Selangor. The places including recreational park, garden, housing area, wet market and supermarket. Before distributing the questionnaire, the researcher gave a brief explanation regarding the purpose of the study and the information sheet. After agreement of participants to participate in the survey, they were required to sign on the consent form. Participants were prompted to answer the questions accordingly and any inquires with respect to the questionnaire can be asked with author on the spot. After participants completed the questionnaire, they were given a pamphlet regarding some basic stretching technique from neck to calf.

On the other hand, an online survey of the questionnaire was also provided for housewives who were not available to meet up in Selangor. A brief and clear description with poster and a universal resource locator (URL) of the online questionnaires was sent to Facebook group page whom mostly targeting women in Selangor. All the questions from the paper version of questionnaire were converted into google form. The pamphlet regarding basic stretching from neck to calf was given after completed the google form. However, due to slow response rate, the description, poster and URL of the online questionnaire was disseminated by a physiotherapy Facebook page, Movelt Physiotherapy for gaining better responses.

3.7 Data Analysis
Descriptive analysis was performed to summarize the data collected after all modified questionnaire being compiled. Frequency and percentage for nominal data was analysis. Chi-square analysis was used to assess the relationship between the variables to the work-related musculoskeletal disorder. Analysis was performed between age, ethnicity, highest level of education attained, duration of work on household activities, types of household activities done, any help from domestic, types of exercise done, duration of exercise, stress level and site of disorders. Data analysis was performed with IBM SPSS Statistics 23. The alpha level was set to p < 0.05 to statistically significant.
IV. RESULTS

This chapter reports the results and discussion of the findings of this study. It includes the baseline characteristics of the study sample, the normality of data distribution and the hypothesis testing.

4.1 Social-demographic and Personal Data

Table 4.1.1: Number of participants and method of obtained responses.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>309</td>
</tr>
<tr>
<td>Housewife</td>
<td>308 (99.7%)</td>
</tr>
<tr>
<td>Working woman</td>
<td>1 (0.3%)</td>
</tr>
<tr>
<td>Duration of being housewife</td>
<td></td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>0 (0)</td>
</tr>
<tr>
<td>More than 1 year</td>
<td>308 (100%)</td>
</tr>
<tr>
<td>Response</td>
<td></td>
</tr>
<tr>
<td>Face to face survey administration</td>
<td>229 (74.4%)</td>
</tr>
<tr>
<td>Online questionnaire</td>
<td>79 (25.6%)</td>
</tr>
</tbody>
</table>

A total number of 309 participants (housewife = 308 (99.7%), working woman = 1 (0.3%)) completely filled the modified questionnaire. 308 housewives were all being housewife more than 1 year (100%). There were 229 responses (74.4%) obtained from face to face survey administration and 79 responses (25.6%) from online questionnaire. There was 1 respond did not meet the inclusion criteria.
Table 4.1.2: Age range among participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>25-30</td>
<td>10 (3.2)</td>
</tr>
<tr>
<td>31-35</td>
<td>48 (15.6)</td>
</tr>
<tr>
<td>36-40</td>
<td>86 (27.9)</td>
</tr>
<tr>
<td>41-45</td>
<td>90 (29.2)</td>
</tr>
<tr>
<td>46-50</td>
<td>73 (23.7)</td>
</tr>
</tbody>
</table>

Figure 4.1.1 Pie chart of age range among participants

Most of the participants were in the age range of 41-45 years (n = 90, 29.2%), followed by 36-40 years (n = 86, 27.9%), 46-50 years (n = 73, 23.7%), 31-35 years (n = 48, 15.6%) and 25-30 years (n = 10, 3.2%). There was only one participant in age range of 18-24 years (0.03%).
### Table 4.1.3: Ethnicity of participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td>256 (83.1)</td>
</tr>
<tr>
<td>Malay</td>
<td>30 (9.7)</td>
</tr>
<tr>
<td>Indian</td>
<td>22 (7.1)</td>
</tr>
</tbody>
</table>

**Figure 4.1.2 Pie chart of ethnicity of participants**

The majority of participants in this study were Chinese (n = 256, 83.1%). Malay participants consisted of 30 (9.7%) and Indian participants consisted of 22 (7.1%).
Table 4.1.4: Education level that obtained from participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education level that obtained</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>19 (6.2)</td>
</tr>
<tr>
<td>Secondary</td>
<td>209 (67.9)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>80 (26.0)</td>
</tr>
</tbody>
</table>

Figure 4.1.3 Pie chart of education level that obtained from participants

The most common education level that obtained by the participants were secondary education (n = 209, 67.9%), followed by tertiary education (n = 80, 26.0%) and primary education (n = 19, 6.2%).
Table 4.1.5: Number of children obtained from participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of children</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>19 (6.2)</td>
</tr>
<tr>
<td>1</td>
<td>31 (10.1)</td>
</tr>
<tr>
<td>2</td>
<td>102 (33.1)</td>
</tr>
<tr>
<td>3</td>
<td>98 (31.8)</td>
</tr>
<tr>
<td>4</td>
<td>47 (15.3)</td>
</tr>
<tr>
<td>5</td>
<td>9 (2.9)</td>
</tr>
<tr>
<td>6</td>
<td>2 (0.6)</td>
</tr>
</tbody>
</table>

Figure 4.1.4 Pie chart of number of children obtained by participants

The most common number of children obtained by participants were two children (n = 102, 33.1%), followed by three children (n = 98, 31.8%), four children (n = 47, 15.3%), one child (n = 1, 10.1%), no child (n = 19, 6.2%), five children (n = 9, 2.9%) and six children (n = 2, 0.6%).
4.2 Activity Data

Table 4.2.1 Hours spend on household activities every day.

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours spend on household activities</td>
<td></td>
</tr>
<tr>
<td>Less than 1 hour</td>
<td>16 (5.2)</td>
</tr>
<tr>
<td>1-2 hours</td>
<td>77 (25.0)</td>
</tr>
<tr>
<td>3-4 hours</td>
<td>121 (39.3)</td>
</tr>
<tr>
<td>5-6 hours</td>
<td>59 (19.2)</td>
</tr>
<tr>
<td>7-8 hours</td>
<td>21 (6.8)</td>
</tr>
<tr>
<td>More than 8 hours</td>
<td>13 (4.2)</td>
</tr>
</tbody>
</table>

Figure 4.1.5 Pie chart of duration of participants spend on household activities

Regarding the duration of participants spend on household activities, 121 participants (39.3%) reported that they spending 3 to 4 hours every day. There were 77 participants (25.0%) spend 1 to 2 hours every day on household activities. There were 59 (19.2%) participants reported spending 5 to 6 hours for household activities, 21 (6.8%) participants spend 7 to 8 hours each day and 13 (4.2%) participants spend less than 1 hour on household activities. The least participants (n = 13, 4.2%) reported spending more than 8 hours on daily household activities.

Table 4.2.2 Types of household activities

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of household activities</td>
<td></td>
</tr>
<tr>
<td>Sweeping</td>
<td>252 (23.5)</td>
</tr>
<tr>
<td>Mopping</td>
<td>251 (23.4)</td>
</tr>
<tr>
<td>Washing</td>
<td>111 (10.3)</td>
</tr>
<tr>
<td>Cooking</td>
<td>260 (33.6)</td>
</tr>
<tr>
<td>Parental care</td>
<td>138 (12.9)</td>
</tr>
<tr>
<td>Grocery shopping</td>
<td>61 (5.7)</td>
</tr>
</tbody>
</table>
Based on the types of household activities, cooking was the most common activity done by the participants (n = 260, 33.6%). Household activities like sweeping and mopping were having quite similar amount of participants, which were 252 (23.5%) and 251 (23.4%) respectively. There were 138 participants (12.9%) reported perform parental care every day and 111 participants (10.3%) performed washing activities. The least activity performed by participants (n = 61, 5.7%) was grocery shopping.

**Table 4.2.3 Assistance from domestic help**

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic help</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>51 (16.6)</td>
</tr>
<tr>
<td>No</td>
<td>257 (83.4)</td>
</tr>
</tbody>
</table>

There were 51 participants (16.6%) having domestic help to perform household activities, whereas 257 participants (83.4%) did not having assistance help from domestic help.
Table 4.2.4 Exercise

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>276 (89.6)</td>
</tr>
<tr>
<td>No</td>
<td>32 (10.4)</td>
</tr>
</tbody>
</table>

Figure 4.1.7 Pie chart of exercise performance

Most of the participants (n = 276, 89.6%) were performing exercise activity, whereas 32 participants (10.4%) were not perform any kind of exercise.

Table 4.2.5 Types of exercise

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of exercise</td>
<td></td>
</tr>
<tr>
<td>Walking</td>
<td>157 (51.0)</td>
</tr>
<tr>
<td>Jogging</td>
<td>64 (20.8)</td>
</tr>
<tr>
<td>Swimming</td>
<td>42 (13.6)</td>
</tr>
<tr>
<td>Cycling</td>
<td>84 (27.3)</td>
</tr>
<tr>
<td>Yoga</td>
<td>21 (6.8)</td>
</tr>
<tr>
<td>Aerobic</td>
<td>4 (1.3)</td>
</tr>
<tr>
<td>Stretching</td>
<td>13 (4.2)</td>
</tr>
<tr>
<td>Dancing</td>
<td>12 (3.9)</td>
</tr>
<tr>
<td>Gym</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>Taichi</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Golf</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Badminton</td>
<td>1 (0.3)</td>
</tr>
</tbody>
</table>
Approximately half of the participants (n = 157, 51.0%) walked as their exercise activity. The second most frequent exercise among the participants was cycling (n = 84, 27.3%). 64 participants (20.8%) jogged, followed by swimming (n = 42, 13.6%) and yoga (n = 21, 6.8%). There were 13 participants (4.2%) performed stretching as exercise and 12 participants (3.9%) dancing. The not so common exercise among the participants were aerobic (n = 4, 1.3%), gym (n = 2, 0.6%), taichi (n = 1, 0.3%), golf (n = 1, 0.3%) and badminton (n = 1, 0.3%).

Table 4.2.6 Duration of exercise

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of exercise</td>
<td></td>
</tr>
<tr>
<td>Less than 30 minutes</td>
<td>56 (18.2)</td>
</tr>
<tr>
<td>30 minutes to 1 hour</td>
<td>191 (62.0)</td>
</tr>
<tr>
<td>More than 1 hour</td>
<td>29 (9.4)</td>
</tr>
</tbody>
</table>

Figure 4.1.8: Bar chart of types of exercise

Figure 4.1.9: Pie chart of duration of exercise
Regarding the duration of exercise, most participants (n = 191, 62.0%) reported exercising for 30 minutes to 1 hour. There were 56 participants (18.2%) exercising less than 30 minutes and 29 participants (9.4%) exercising more than 1 hour.

Table 4.2.7 Perceived Stress Scale

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Stress Scale</td>
<td></td>
</tr>
<tr>
<td>Low stress (0-13)</td>
<td>91 (29.5)</td>
</tr>
<tr>
<td>Moderate stress (14-26)</td>
<td>217 (70.5)</td>
</tr>
<tr>
<td>High perceived stress (27-40)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

Figure 4.1.10 Pie chart of stress level

Regarding the stress level among participants, there were high percentage 70.5% of participants (n = 217) having moderate stress level. Participants which having low stress level were 91 (29.5%). Fortunately, there was no participant having high perceived stress level.

Table 4.2.8 Physiotherapy treatment for work-related musculoskeletal disorders

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiotherapy treatment</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15 (4.9)</td>
</tr>
<tr>
<td>No</td>
<td>293 (95.1)</td>
</tr>
</tbody>
</table>
Regarding the acknowledgement of physiotherapy treatment for work-related musculoskeletal disorders among housewives, there were only 4.9% of participants (n = 15) have been received physiotherapy treatment. 293 participants (95.1%) have not received any physiotherapy treatment before.
4.3 Characteristics of Work-related Musculoskeletal Disorders

Table 4.3.1: Present of any work-related musculoskeletal injury in the past 12 months.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any pain/ discomfort</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>231 (75.0%)</td>
</tr>
<tr>
<td>No</td>
<td>77 (25.0%)</td>
</tr>
</tbody>
</table>

Figure 4.1.12 Pie chart of any work-related musculoskeletal disorders

During the past 12 months, there were 75% of participants (n = 231) reported that they are pain or discomfort on their body parts, whereas 25% of participants (n = 77) did not encounter any pain and discomfort.

Table 4.3.2: Present of any work-related musculoskeletal injury during last 12 months.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of injured body parts</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>77 (25.0)</td>
</tr>
<tr>
<td>1</td>
<td>107 (34.7)</td>
</tr>
<tr>
<td>2</td>
<td>91 (29.5)</td>
</tr>
<tr>
<td>3</td>
<td>19 (6.2)</td>
</tr>
<tr>
<td>4</td>
<td>8 (2.6)</td>
</tr>
<tr>
<td>5</td>
<td>3 (1.0)</td>
</tr>
<tr>
<td>6</td>
<td>3 (1.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part of body</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>47 (10.6)</td>
</tr>
<tr>
<td>Shoulder (Left)</td>
<td>11 (2.5)</td>
</tr>
<tr>
<td>Shoulder (Right)</td>
<td>31 (7.0)</td>
</tr>
<tr>
<td>Shoulder (Both)</td>
<td>26 (5.9)</td>
</tr>
<tr>
<td>Elbow (Left)</td>
<td>1 (0.2)</td>
</tr>
<tr>
<td>Elbow (Right)</td>
<td>16 (3.6)</td>
</tr>
<tr>
<td>Elbow (Both)</td>
<td>2 (0.4)</td>
</tr>
</tbody>
</table>
Regarding the number of injured body part of participants in 12 months, 107 (34.7%) of 231 participants reported sustained one work-related musculoskeletal injury. 91 participants (29.5%) did reported that they having two injured body parts, 19 participants (6.2%) reported having three injured body parts and 8 participants (2.6%) mentioned of having four injured body parts in the preceding 12 months. Whereas, participants that having five and six injured body part during the last 12 months were respectively 3 (1.0%). Number of participants that not having any injured body part (n = 77, 25%) were same as the number of participants that reported not having any pain and discomfort in Table 4.3.1.

According to Table 4.3.2, body part of work-related musculoskeletal disorders encounter by participants were reported. A total of 442 injured body parts reported from 231 participants in the previous 12 months. The injured body region consisting of axial region (n = 152, 34.4%), upper extremity (n = 129, 29.2%) and lower extremity (n = 161, 36.4%).
In axial region, the most frequent injured body region was lower back (n = 84, 19.0%). Neck was the second common injured part in axial region. There were 47 participants (10.6%) complaint of foot and ankle pain. The least reported axial region was upper back. Only 21 participants (4.8%) reported of pain at hip and thigh.

For upper extremity, there were 3 parts, shoulder, elbow and wrist. Right shoulder was the most frequent injured shoulder region (n = 31, 7.0%) compare to left shoulder (n = 11, 2.5%). There were 26 participants (5.9%) reported of both shoulder pain. For elbow, right elbow (n = 16, 3.6%) was also injured by more participants compare to left elbow (n = 1, 0.2%). There was two complaints reported of both elbow pain (0.4%). For wrist and hand region, 38 participants (8.6%) reported of pain at right wrist and hand and four participants (0.9%) reported pain at both wrist. There was no participants reported of left wrist pain.

For lower extremity, the most frequent injured part was knee. There were 75 participants (17.0%) reported of pain on their knee. Foot and ankle was the second common injured part in lower extremity. There were 65 participants (14.7%) complaint of foot and ankle pain. Only 21 participants (4.8%) reported of pain at hip and thigh.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of injured body parts</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>253 (82.1)</td>
</tr>
<tr>
<td>1</td>
<td>43 (14.0)</td>
</tr>
<tr>
<td>2</td>
<td>7 (2.3)</td>
</tr>
<tr>
<td>3</td>
<td>3 (1.0)</td>
</tr>
<tr>
<td>4</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>5</td>
<td>1 (0.3)</td>
</tr>
<tr>
<td>Part of body</td>
<td></td>
</tr>
<tr>
<td>Neck</td>
<td>12 (15.2)</td>
</tr>
<tr>
<td>Shoulder</td>
<td>16 (20.3)</td>
</tr>
<tr>
<td>Elbow</td>
<td>2 (2.5)</td>
</tr>
<tr>
<td>Wrist/ Hand</td>
<td>10 (12.7)</td>
</tr>
<tr>
<td>Upper Back</td>
<td>5 (6.3)</td>
</tr>
<tr>
<td>Lower Back</td>
<td>9 (11.4)</td>
</tr>
<tr>
<td>Hip/ Thigh</td>
<td>1 (1.3)</td>
</tr>
<tr>
<td>Knee</td>
<td>15 (19.0)</td>
</tr>
<tr>
<td>Feet/ Ankle</td>
<td>9 (11.4)</td>
</tr>
</tbody>
</table>
During the past 12 months, there were 56 participants (17.9%) who have been prevented from doing their normal work because of work-related musculoskeletal disorders. Most of the participants reported sustained only one work-related musculoskeletal injury (n = 107, 34.7%). 91 participants (29.5%) did report that they having two injured body parts, 19 participants (6.2%) reported having three injured body parts and eight participants (2.6%) mentioned of having four injured body parts in the preceding 12 months. Whereas, participants that having five and six injured body part during the last 12 months were respectively 3 (1.0%). Number of participants that not having any injured body part (n = 77, 25%) were same as the number of participants that reported not having any pain and discomfort in Table 4.3.1.

Among those 55 participants, there were 79 body parts were injured and prevented them from normal work as housewife. The injured body region consisting of axial region (n = 26, 32.9%), upper extremity (n = 28, 35.4%) and lower extremity (n = 25, 31.6%). In axial region, the most frequent injured body region was neck (n = 12, 15.2%). Lower back was the second common injured part in axial region. There were nine participants (11.4%) complaint of foot and ankle pain. The least reported axial region was upper back. Only five participants (6.3%) reported of pain at upper back region.

For upper extremity, there were three parts, shoulder, elbow and wrist. Shoulder was the most frequent injured shoulder region (n = 16, 20.3%). There were two participants (2.5%) reported of elbow pain. For wrist and hand region, ten participants (12.7%) reported pain.

For lower extremity, the most frequent injured part was knee. There were 15 participants (19.0%) reported of pain on their knee. Foot and ankle was the second common injured part in lower extremity. There were nine participants (11.4%) complaint of foot and ankle pain. Only one participants (1.3%) reported of pain at hip and thigh.
Table 4.3.4: Presence of any work-related musculoskeletal injury during last 7 days.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of injured body parts</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>252 (81.8)</td>
</tr>
<tr>
<td>1</td>
<td>39 (12.7)</td>
</tr>
<tr>
<td>2</td>
<td>10 (3.2)</td>
</tr>
<tr>
<td>3</td>
<td>5 (1.6)</td>
</tr>
<tr>
<td>4</td>
<td>0 (0)</td>
</tr>
<tr>
<td>5</td>
<td>2 (0.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part of body</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>15 (16.3)</td>
</tr>
<tr>
<td>Shoulder</td>
<td>15 (16.3)</td>
</tr>
<tr>
<td>Elbow</td>
<td>2 (2.2)</td>
</tr>
<tr>
<td>Wrist/ Hand</td>
<td>7 (7.6)</td>
</tr>
<tr>
<td>Upper Back</td>
<td>7 (7.6)</td>
</tr>
<tr>
<td>Lower Back</td>
<td>13 (14.1)</td>
</tr>
<tr>
<td>Hip/ Thigh</td>
<td>4 (4.3)</td>
</tr>
<tr>
<td>Knee</td>
<td>20 (21.7)</td>
</tr>
<tr>
<td>Feet/ Ankle</td>
<td>9 (9.8)</td>
</tr>
</tbody>
</table>

During the past 7 days, there were 56 participants (18.2%) reported having work-related musculoskeletal pain. 39 participants (12.7%) reported having one injured body part that prevented them from work. Ten participants (3.2%) reported that they were having two injured body part in last 7 days. There five participants (1.6%) having three injured body parts that prevented them from household activities, followed by five injured body parts (n = 2, 0.6%).
Figure 4.1.18 Bar chart of body parts that prevented participants from normal in the past 7 days.

Among those 56 participants, there were 92 body parts were injured during the past 7 days. The injured body region consisting of axial region (n = 35, 38.0%), upper extremity (n = 24, 26.1%) and lower extremity (n = 33, 35.9%).

In axial region, the most frequent injured body region was neck (n = 15, 16.3%). Lower back was the second common injured part in axial region. There were 13 participants (14.1%) complaint of lower back pain. The least reported axial region was upper back. Only seven participants (7.6%) reported of pain at upper back in past 7 days.

For upper extremity, there were three parts, shoulder, elbow and wrist. Shoulder was the most frequent injured shoulder region (n = 15, 16.3%). There were two participants (2.2%) reported of elbow pain. For wrist and hand region, seven participants (7.6%) reported pain.

For lower extremity, the most frequent injured part was knee. There were 20 participants (21.7%) reported of pain on their knee. Foot and ankle was the second common injured part in lower extremity. There were nine participants (9.8%) complaint of foot and ankle pain. There was only four participants (4.3%) reported of pain at hip and thigh.
### 4.4 Comparison of Different household activities and different body parts

Table 4.4.1: Types of household activities with body parts that encounter work-related musculoskeletal disorders during the past 12 months.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Injured body part, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Neck</td>
</tr>
<tr>
<td>Sweeping</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>(9.8)</td>
</tr>
<tr>
<td>Mopping</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>(9.6)</td>
</tr>
<tr>
<td>Washing</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>(13.0)</td>
</tr>
<tr>
<td>Cooking</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>(10.2)</td>
</tr>
<tr>
<td>Parental care</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>(8.9)</td>
</tr>
<tr>
<td>Grocery shopping</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>(15.6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Wrist/ Hand (Left)</th>
<th>Wrist/ Hand (Right)</th>
<th>Wrist/ Hand (Both)</th>
<th>Upper Back</th>
<th>Lower Back</th>
<th>Hip/Thigh</th>
<th>Knee</th>
<th>Feet/Ankle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweeping</td>
<td>0</td>
<td>32</td>
<td>4</td>
<td>17</td>
<td>64</td>
<td>16</td>
<td>61</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(9.0)</td>
<td>(1.1)</td>
<td>(4.8)</td>
<td>(17.9)</td>
<td>(4.5)</td>
<td>(17.1)</td>
<td>(16.8)</td>
</tr>
<tr>
<td>Mopping</td>
<td>0</td>
<td>31</td>
<td>4</td>
<td>17</td>
<td>63</td>
<td>15</td>
<td>61</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(8.8)</td>
<td>(1.1)</td>
<td>(4.8)</td>
<td>(17.8)</td>
<td>(4.2)</td>
<td>(17.3)</td>
<td>(17.3)</td>
</tr>
<tr>
<td>Washing</td>
<td>0</td>
<td>13</td>
<td>4</td>
<td>13</td>
<td>29</td>
<td>9</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(6.7)</td>
<td>(2.0)</td>
<td>(6.7)</td>
<td>(15.0)</td>
<td>(4.7)</td>
<td>(15.5)</td>
<td>(16.1)</td>
</tr>
<tr>
<td>Cooking</td>
<td>0</td>
<td>34</td>
<td>4</td>
<td>19</td>
<td>74</td>
<td>14</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(8.9)</td>
<td>(1.2)</td>
<td>(5.0)</td>
<td>(19.4)</td>
<td>(3.7)</td>
<td>(17.1)</td>
<td>(14.4)</td>
</tr>
<tr>
<td>Parental care</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>8</td>
<td>46</td>
<td>9</td>
<td>24</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(8.4)</td>
<td>(0.5)</td>
<td>(4.0)</td>
<td>(22.8)</td>
<td>(4.5)</td>
<td>(11.9)</td>
<td>(14.4)</td>
</tr>
<tr>
<td>Grocery shopping</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>12</td>
<td>5</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td>(5.2)</td>
<td>(2.1)</td>
<td>(7.3)</td>
<td>(12.5)</td>
<td>(5.2)</td>
<td>(15.6)</td>
<td>(14.6)</td>
</tr>
</tbody>
</table>
Table 4.4.1 shows according the different types of household activities which cause injured body parts that encounter work-related musculoskeletal disorders. Participants reported that most injured body was lower back region. Most of the reported work-related musculoskeletal disorders among housewives was related to cooking.

<table>
<thead>
<tr>
<th>Injured body part</th>
<th>Household activities, n (%)</th>
<th>Sweep- ing</th>
<th>Mop- ping</th>
<th>Wash- ing</th>
<th>Cook- ing</th>
<th>Parental Care</th>
<th>Grocery Shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td></td>
<td>35</td>
<td>34</td>
<td>25</td>
<td>39</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>(21.1)</td>
<td>(20.5)</td>
<td>(15.1)</td>
<td>(23.5)</td>
<td>(10.8)</td>
<td>(9.0)</td>
<td></td>
</tr>
</tbody>
</table>

Regarding sweeping and mopping, there were similar frequency of injured body part. For participants that always perform sweeping (17.9%) and mopping (17.8%), the most frequent injured body part was lower back region, followed by knee, feet/ ankle, neck, right wrist/ hand, both of shoulder, right shoulder, upper back, hip/ thigh, right elbow, left shoulder, both of wrist/ hand, both of elbow and left elbow. Left wrist/ hand was not encounter by any participants whom perform sweeping.

Participants who perform washing sustained most injury of feet/ ankle (16.1%). The frequency of having knee (15.5%) and lower back (15.0%) disorder were quite similar with feet/ ankle. The following injured body parts were neck, right wrist/ hand, upper back, both of shoulder, hip/ thigh, right shoulder, left shoulder, right elbow, both of wrist/ hand both elbow and left elbow. There was no participant encounter pain on left wrist/ hand.

There were 19.4% of participants had lower back disorders after performing cooking at home. The sequent was followed by knee, feet/ ankle, neck, right wrist/ hand, right shoulder, both of shoulder, upper back, hip/ thigh, right elbow, left shoulder, both of wrist/ hand, both of elbow, left elbow and left wrist/ hand (0%).

For parental care, lower back disorders (22.8%) still the most frequent encounter work-related musculoskeletal disorders among housewives. Feet/ ankle was the next and following with knee, neck, right wrist/ hand, right shoulder, both shoulder, right elbow, hip/ thigh, upper back, left shoulder, both of elbow and both of wrist/ hand. Left elbow and left wrist/ hand were not reported by the participants.

Lastly, regarding grocery shopping, there were two body parts that encounter most work-related musculoskeletal disorders among housewives. There were neck and knee region, which were 15.6% respectively. The other body region that have quite similar amount of participants encounter was feet/ ankle. Next followed by lower back, both of shoulder, upper back, right shoulder, right wrist/ hand, hip/ thigh, left shoulder, right elbow, both of wrist/ hand and both of elbow. There were two body parts that not encounter among housewives, which were left elbow and left wrist/ hand.

Table 4.4.2: Types of household activities with neck work-related musculoskeletal disorders during the past 12 months.

<table>
<thead>
<tr>
<th>Injured body part</th>
<th>Household activities, n (%)</th>
<th>Sweep- ing</th>
<th>Mop- ping</th>
<th>Wash- ing</th>
<th>Cook- ing</th>
<th>Parental Care</th>
<th>Grocery Shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder</td>
<td></td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>10</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>(Left)</td>
<td>(19.0)</td>
<td>(21.4)</td>
<td>(11.9)</td>
<td>(23.8)</td>
<td>(16.7)</td>
<td>(7.1)</td>
<td></td>
</tr>
</tbody>
</table>

Table 4.4.3: Types of household activities with left shoulder work-related musculoskeletal disorders during the past 12 months.

For injured left shoulder, the reported most perform household activity was cooking (23.8%). The following household activities that might cause left shoulder injury were mopping, sweeping, parental care, washing and grocery shopping.
Table 4.4.4: Types of household activities with right shoulder work-related musculoskeletal disorders during the past 12 months.

28 out of 100 amount of household activities were from cooking. Cooking (28%) was the highest frequency of household activity which caused right shoulder work-related musculoskeletal disorders. The rest household activities that cause right shoulder work-related musculoskeletal disorders were according sweeping, mopping, parental care, washing and grocery shopping respectively.

<table>
<thead>
<tr>
<th>Injured body part</th>
<th>Household activities, n (%)</th>
<th>Sweep-ing</th>
<th>Mop-ping</th>
<th>Wash-ing</th>
<th>Cook-ing</th>
<th>Parental Care</th>
<th>Grocery Shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder (Right)</td>
<td></td>
<td>22</td>
<td>21</td>
<td>6</td>
<td>28</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(22.0)</td>
<td>(21.0)</td>
<td>(6.0)</td>
<td>(28.0)</td>
<td>(17.0)</td>
<td>(6.0)</td>
</tr>
</tbody>
</table>

Table 4.4.5: Types of household activities with both shoulder work-related musculoskeletal disorders during the past 12 months.

Cooking (22.8%) still the most frequent household activity that performed among both shoulder work-related musculoskeletal disorders participants. However, the frequency of both sweeping (21.8%) and mopping (21.8%) were similar to cooking. The following sequence will be parental care, washing and grocery shopping.

<table>
<thead>
<tr>
<th>Injured body part</th>
<th>Household activities, n (%)</th>
<th>Sweep-ing</th>
<th>Mop-ping</th>
<th>Wash-ing</th>
<th>Cook-ing</th>
<th>Parental Care</th>
<th>Grocery Shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elbow (Left)</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(25.0)</td>
<td>(25.0)</td>
<td>(25.0)</td>
<td>(25.0)</td>
<td>(0.0)</td>
<td>(0.0)</td>
</tr>
</tbody>
</table>

Table 4.4.6: Types of household activities with left elbow work-related musculoskeletal disorders during the past 12 months.

Regarding left elbow work-related musculoskeletal disorders, there were equal frequency of household activities which are sweeping, mopping, washing and cooking. The frequency was 25% respectively.

<table>
<thead>
<tr>
<th>Injured body part</th>
<th>Household activities, n (%)</th>
<th>Sweep-ing</th>
<th>Mop-ping</th>
<th>Wash-ing</th>
<th>Cook-ing</th>
<th>Parental Care</th>
<th>Grocery Shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elbow (Right)</td>
<td></td>
<td>13</td>
<td>12</td>
<td>4</td>
<td>13</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(23.6)</td>
<td>(21.8)</td>
<td>(7.3)</td>
<td>(23.6)</td>
<td>(20.0)</td>
<td>(3.6)</td>
</tr>
</tbody>
</table>

Table 4.4.7: Types of household activities with right elbow work-related musculoskeletal disorders during the past 12 months.

The frequency of sweeping, mopping, cooking and parental care was about the same, it was 23.6%, 21.8%, 23.6% and 20.0% respectively. These four types of household activities were the most performed among housewives whom encounter right elbow musculoskeletal disorders. Whereas, washing and grocery shopping were the least performed household activities.

<table>
<thead>
<tr>
<th>Injured body part</th>
<th>Household activities, n (%)</th>
<th>Sweep-ing</th>
<th>Mop-ping</th>
<th>Wash-ing</th>
<th>Cook-ing</th>
<th>Parental Care</th>
<th>Grocery Shopping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder (Both)</td>
<td></td>
<td>22</td>
<td>22</td>
<td>12</td>
<td>23</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(21.8)</td>
<td>(21.8)</td>
<td>(11.9)</td>
<td>(22.8)</td>
<td>(12.9)</td>
<td>(8.9)</td>
</tr>
</tbody>
</table>
Table 4.4.8: Types of household activities with both elbow work-related musculoskeletal disorders during the past 12 months.

For the both elbow work-related musculoskeletal disorders, all of the household activities, sweeping, mopping, washing, cooking and parental care had the same frequency which was 18.2% except for grocery shopping (9%).

Table 4.4.9: Types of household activities with right wrist/ hand work-related musculoskeletal disorders during the past 12 months.

Cooking, sweeping and mopping consisted of equally same frequency of household activities, which were 25.8%, 24.2% and 23.5% respectively. This means that they having same probability cause right wrist/ hand work-related musculoskeletal disorders. The rest household activities were followed by parental care, washing and grocery shopping.
Table 4.4.10: Types of household activities with both wrist/ hand work-related musculoskeletal disorders during the past 12 months.

For both of wrist/ hand musculoskeletal disorders, there were 4 types of household activities having same frequency (21.1%), which are sweeping, mopping, washing and cooking. Parental care and grocery shopping were least frequency compare to them, which also mean that they were comparative less chance to cause both of wrist/ hand injury.

Table 4.4.11: Types of household activities with upper back work-related musculoskeletal disorders during the past 12 months.

For upper back work-related musculoskeletal disorders, the reported most perform household activity was cooking (23.5%). The second frequent household activities were sweeping and mopping. The following household activities that might cause upper back injury were washing, parental care and grocery shopping.

Table 4.4.12: Types of household activities with lower back work-related musculoskeletal disorders during the past 12 months.

Lower back was the most affected part of work-related musculoskeletal disorders among housewives. The most performed household activity by housewives whom encounter lower back injury was cooking (25.7%). The rest household activities that cause lower back work-related musculoskeletal disorders were according sweeping, mopping, parental care, washing and grocery shopping.

Table 4.4.13: Types of household activities with hip/ thigh work-related musculoskeletal disorders during the past 12 months.

Regarding hip/ thigh work-related musculoskeletal disorders, the highest frequency of household activity involved was sweeping (23.5%). The frequency of mopping and cooking were also just few amount least than sweeping. Washing, parental care and grocery shopping were listed accordingly.
Table 4.4.14: Types of household activities with knee work-related musculoskeletal disorders during the past 12 months.

65 out of 256 amount of household activities were from cooking. Cooking (25.4%) was the highest frequency of household activity which caused knee work-related musculoskeletal disorders. The rest household activities that cause knee work-related musculoskeletal disorders were according sweeping, mopping, parental care, washing and grocery shopping respectively.

<table>
<thead>
<tr>
<th>Injured body part</th>
<th>Household activities, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sweep-ing</td>
</tr>
<tr>
<td>Knee</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>(23.8)</td>
</tr>
</tbody>
</table>

Table 4.4.15: Types of household activities with feet/ankle work-related musculoskeletal disorders during the past 12 months.

The most performed household activity by housewives whom encounter feet/ankle injury was mopping (24.2%). Sweeping (24.0%) was having similar frequency of household activity as mopping. The rest household activities that cause feet/ankle work-related musculoskeletal disorders were according cooking, washing, parental care and grocery shopping.

<table>
<thead>
<tr>
<th>Injured body part</th>
<th>Household activities, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sweep-ing</td>
</tr>
<tr>
<td>Feet/Ankle</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>(24.0)</td>
</tr>
</tbody>
</table>
Table 4.4.16 Types of exercise with work-related musculoskeletal disorders.

According to table 4.4.16, there show the most frequent performed exercise is walking. For walking, there show only 18.5% of them did not encounter work-related musculoskeletal disorders. It is same as dancing that show 16.7% of them did not have work-related musculoskeletal disorders. Whereas the other types of exercise show lower rate of participants encounter work-related musculoskeletal disorders. Golf exercise shows lowest rate of getting work-related musculoskeletal disorders. Taichi and badminton show the highest rate of getting work-related musculoskeletal disorders among housewives.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Work-related musculoskeletal disorders, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Walking</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>(81.5)</td>
</tr>
<tr>
<td>Jogging</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>(73.4)</td>
</tr>
<tr>
<td>Swimming</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>(78.6)</td>
</tr>
<tr>
<td>Cycling</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>(78.6)</td>
</tr>
<tr>
<td>Yoga</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>(76.2)</td>
</tr>
<tr>
<td>Aerobic</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>(50.0)</td>
</tr>
<tr>
<td>Stretching</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>(61.5)</td>
</tr>
<tr>
<td>Dancing</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(83.3)</td>
</tr>
<tr>
<td>Gym</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(50.0)</td>
</tr>
<tr>
<td>Taichi</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
</tr>
<tr>
<td>Golf</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>(0.0)</td>
</tr>
<tr>
<td>Badminton</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(100.0)</td>
</tr>
</tbody>
</table>
4.5 Association of Different Variables and Work-related Musculoskeletal Disorders.

Table 4.5.1: Association between age and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Age</th>
<th>Work-related musculoskeletal disorders</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>1 (100.0)</td>
<td>0 (0)</td>
<td>14.036*</td>
<td>5</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>25-30</td>
<td>7 (70.0)</td>
<td>3 (30.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-35</td>
<td>40 (83.3)</td>
<td>8 (16.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36-40</td>
<td>64 (74.4)</td>
<td>22 (25.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41-45</td>
<td>75 (83.3)</td>
<td>15 (16.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46-50</td>
<td>44 (53.0)</td>
<td>29 (47.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05,

The association between age and work-related musculoskeletal disorders in the past 12 months was determined by using Chi-square test. The number of participants who were had work-related musculoskeletal disorders in the age range of 18 to 24 was one (100%), followed by 25 to 30 years (n = 7, 70.0%). The number of participants whom had work-related musculoskeletal disorders increase to 40 (83.3%) at the age of 31 to 35, followed by the age of 36 to 40 (n = 64, 74.4%). The age range which have the highest number of participants (75, 83.3%) of getting work-related musculoskeletal disorders was 41 to 45 years. At the age of 46 to 50, there were 44 participants (53.0%) had work-related musculoskeletal disorders. The difference in the work-related musculoskeletal disorders between age range among housewives was statistically significant as p = 0.015, which stated that there was correspond between age and work-related musculoskeletal disorders.

Table 4.5.2: Association between ethnicity and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Work-related musculoskeletal disorders</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>186 (72.7)</td>
<td>70 (27.3)</td>
<td>4.831*</td>
<td>0</td>
<td>0.089</td>
<td></td>
</tr>
<tr>
<td>Malay</td>
<td>25 (83.3)</td>
<td>5 (16.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indian</td>
<td>20 (90.9)</td>
<td>2 (9.9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05,

Chi-square test was used to investigate the association of ethnicity and work-related musculoskeletal disorders in the past 12 months. The number of participants who had work-related musculoskeletal disorders among ethnicity was Chinese (n = 186, 60.4%), Malay (n = 25, 8.1%) and Indian (n = 4, 25.0%). The difference in the work-related musculoskeletal disorders and ethnicity was not statistically significant as p = 0.089. It shows that ethnicity was not associated with work-related musculoskeletal disorders among housewives.

Table 4.5.3: Association among the education level that obtained and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Education level that obtained</th>
<th>Work-related musculoskeletal disorders</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>13 (68.4)</td>
<td>6 (31.6)</td>
<td>0.720*</td>
<td>2</td>
<td>0.698</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>156 (73.6)</td>
<td>56 (26.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>62 (77.5)</td>
<td>18 (22.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05,

Association between the education level that obtained by participants and work-related musculoskeletal disorders in the past 12 months was tested by chi-square. The number of respondents of primary education who sustained injury was 13 (68.4%), secondary...
education (n = 156, 73.6%), and tertiary (n = 62, 77.5%). The difference in work-related musculoskeletal disorders in the past 12 months between the education level that obtained was not statistically significant as p = 0.698. There shows no correspondence relationship between the education level that obtained among housewives and work-related musculoskeletal disorders.

Table 4.5.4: Association between number of children and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Number of children</th>
<th>Work-related musculoskeletal disorders</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes n (%)</td>
<td>No n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>14 (73.7)</td>
<td>5 (26.3)</td>
<td>6.842*</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>28 (90.0)</td>
<td>3 (10.0)</td>
<td>6.842*</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>71 (69.6)</td>
<td>31 (30.4)</td>
<td>6.842*</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>74 (75.5)</td>
<td>24 (24.5)</td>
<td>6.842*</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>37 (78.7)</td>
<td>10 (21.3)</td>
<td>6.842*</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>6 (66.7)</td>
<td>3 (33.3)</td>
<td>6.842*</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>1 (50.0)</td>
<td>1 (50.0)</td>
<td>6.842*</td>
<td>6</td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.

Chi-square was used to test was the number of children and its association with work-related musculoskeletal disorders in the past 12 months. There were 14 participants (73.7%) had work-related musculoskeletal disorders but did not have any child. The number of participants who were having one child and had work-related musculoskeletal disorders was 28 (90.0%). The number of participants whom having two children and had work-related musculoskeletal disorders increase to 71 (69.6%), followed by having three children (n = 74, 75.5%). 37 participants (78.7%) having four children and had work-related musculoskeletal disorders in past 12 months. The number of participants of having five children decrease to 6 (66.7%), followed by having six children (n = 1, 50.0%). The difference between the work-related musculoskeletal disorders and number of children was not statistically significant as p = 0.336. The number of children obtained by participants was no associated with work-related musculoskeletal disorders among housewives.

Table 4.5.5: Association between duration of household activities and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Duration of household activities</th>
<th>Work-related musculoskeletal disorders</th>
<th>( \chi^2 )</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes n (%)</td>
<td>No n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1 hour</td>
<td>8 (73.7)</td>
<td>5 (26.3)</td>
<td>33.795*</td>
<td>5</td>
</tr>
<tr>
<td>1–2 hours</td>
<td>28 (90.0)</td>
<td>3 (10.0)</td>
<td>33.795*</td>
<td>5</td>
</tr>
<tr>
<td>3–4 hours</td>
<td>71 (69.6)</td>
<td>31 (30.4)</td>
<td>33.795*</td>
<td>5</td>
</tr>
<tr>
<td>5–6 hours</td>
<td>74 (75.5)</td>
<td>24 (24.5)</td>
<td>33.795*</td>
<td>5</td>
</tr>
<tr>
<td>7–8 hours</td>
<td>37 (78.7)</td>
<td>10 (21.3)</td>
<td>33.795*</td>
<td>5</td>
</tr>
<tr>
<td>More than 8 hours</td>
<td>1 (50.0)</td>
<td>1 (50.0)</td>
<td>33.795*</td>
<td>5</td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.

The association between duration of household activities and work-related musculoskeletal disorders in the past 12 months was determined by perform Chi-square test. The number of injured participants who perform household activities less than 1 hour was 8 (73.7%), followed by 1 to 2 hours (n = 28, 90.0%). The number of participants that perform household activities for 3 to 4 hours were 71 (69.6%). Highest number of participants (n =74, 75.5%) perform 5 to 6 hours of household activities. There were 37 participants (78.7%) had work-related musculoskeletal disorders and perform 7 to 8 hours household activities. There was only one participant perform household activities more than 8 hours. The difference between duration of household activities and work-related musculoskeletal disorders among housewives was statistically significant as p < 0.001. The duration of household activities was associated with work-related musculoskeletal disorders.
Table 4.5.6: Association between sweeping and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Work-related musculoskeletal disorders</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
<th>χ²</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweeping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>189 (75.0)</td>
<td>63 (25.0)</td>
<td>&gt;0.001*</td>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>No</td>
<td>42 (75.0)</td>
<td>14 (25.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.

Association between sweeping and work-related musculoskeletal disorders in the past 12 months was investigate by using Chi-square test. Injured participants who performed sweeping were 189 (75.0%) whereas injured participants who did not perform sweeping were 42 (75.0%). The difference in the work-related musculoskeletal disorders between performing sweeping was not statistically significant as p = 1.000. Household activities like sweeping shown no correspond with work-related musculoskeletal disorders among housewives.

Table 4.5.7: Association between mopping and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Work-related musculoskeletal disorders</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
<th>χ²</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mopping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>190 (75.7)</td>
<td>61 (24.3)</td>
<td>0.352*</td>
<td>1</td>
<td>0.553</td>
</tr>
<tr>
<td>No</td>
<td>41 (71.9)</td>
<td>16 (28.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.

Association between household activity like mopping was investigated with work-related musculoskeletal disorders in the past 12 months by using Chi-square test. Injured participants who performed mopping were 190 (75.7%) whereas injured participants who did not perform mopping were 41 (71.9%). The difference in the work-related musculoskeletal disorders between performing mopping was not statistically significant as p = 0.553 Household activities like mopping shown no correspond with work-related musculoskeletal disorders among housewives.

Table 4.5.8: Association between washing and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Work-related musculoskeletal disorders</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
<th>χ²</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>86 (77.5)</td>
<td>25 (22.5)</td>
<td>0.568*</td>
<td>1</td>
<td>0.451</td>
</tr>
<tr>
<td>No</td>
<td>145 (73.6)</td>
<td>52 (26.4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.

Household activity, washing was tested with work-related musculoskeletal disorders in the past 12 months for its association by performing Chi-square test. Injured participants who performed washing were 86 (77.5%) whereas injured participants who did not perform washing were 145 (73.6%). The difference in the work-related musculoskeletal disorders between performing washing was not statistically significant as p = 0.451. There was no association between performing washing and work-related musculoskeletal disorders among housewives.

Table 4.5.9 Association between cooking and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Work-related musculoskeletal disorders</th>
<th>Yes n (%)</th>
<th>No n (%)</th>
<th>χ²</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>199 (76.5)</td>
<td>61 (23.5)</td>
<td>2.106*</td>
<td>1</td>
<td>0.147</td>
</tr>
<tr>
<td>No</td>
<td>32 (66.7)</td>
<td>16 (33.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.
Chi-square test was performed to determine the association between cooking and work-related musculoskeletal disorders in the past 12 months. Injured participants who performed cooking were 199 (76.5%) and participants whom encounter work-related musculoskeletal disorder that not performed cooking were 32 (66.7%). The difference in the work-related musculoskeletal disorders between performing cooking was not statistically significant as p = 0.147. Household activities like cooking shown no correspond with work-related musculoskeletal disorders.

Table 4.5.10: Association between parental care and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Parental care</th>
<th>Work-related musculoskeletal disorders</th>
<th>χ²</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (78.3)</td>
<td></td>
<td></td>
<td>0.234</td>
</tr>
<tr>
<td></td>
<td>No (72.4)</td>
<td>1.418*</td>
<td>1</td>
<td>0.234</td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05,

The correspond relationship between parental care and work-related musculoskeletal disorders in the past 12 months was determined by performing Chi-square test. Injured participants who performed parental care were 108 (78.3%) whereas injured participants who did not perform washing were 123 (72.4%). The difference in the work-related musculoskeletal disorders between performing parental care was not statistically significant as p = 0.234. Household activities like parental shown no correspond with work-related musculoskeletal disorders.

Table 4.5.11: Association between grocery shopping and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Grocery shopping</th>
<th>Work-related musculoskeletal disorders</th>
<th>χ²</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (72.1)</td>
<td>0.334*</td>
<td>1</td>
<td>0.563</td>
</tr>
<tr>
<td></td>
<td>No (75.7)</td>
<td>17 (27.9)</td>
<td>1</td>
<td>0.563</td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05,

To determine the association between grocery shopping and work-related musculoskeletal disorders in the past 12 months, Chi-square test is used. Injured participants who performed grocery shopping were 44 (72.1%) whereas injured participants who did not perform grocery shopping were 187 (75.7%). The difference in the work-related musculoskeletal disorders between performing grocery shopping was not statistically significant as p = 0.451. Household activities like grocery shopping shown no correspond with work-related musculoskeletal disorders among housewives.

Table 4.5.12: Association between domestic help and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Domestic help</th>
<th>Work-related musculoskeletal disorders</th>
<th>χ²</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (80.4)</td>
<td>0.948*</td>
<td>1</td>
<td>0.330</td>
</tr>
<tr>
<td></td>
<td>No (73.9)</td>
<td>10 (19.6)</td>
<td>1</td>
<td>0.330</td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05,

The correspond relationship between domestic help and work-related musculoskeletal disorders in the past 12 months was determined by using Chi-square test. Injured participants who having domestic help were 41 (80.4%) whereas injured participants who did not have any domestic help were 190 (73.9%). There was significant difference in the work-related musculoskeletal disorders with domestic help (p = 0.330). The finding shows that domestic help did not corresponded with work-related musculoskeletal disorders among housewives.
Table 4.5.13: Association between exercise and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Work-related musculoskeletal disorders</th>
<th>n (%)</th>
<th>n (%)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>216</td>
<td>60</td>
<td>15.065*</td>
<td>1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>No</td>
<td>15</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.

To investigate the relationship between exercise and work-related musculoskeletal disorders in the past 12 months, Chi-square test was performed. Injured participants who did perform exercise were 216 (78.3%) whereas injured participants who did not perform any exercise were 15 (46.9%). The difference in the work-related musculoskeletal disorders between exercise was statistically significant as p <0.001. It shows that performing exercise was corresponded with work-related musculoskeletal disorders among housewives.

Table 4.5.14: Association between duration exercise and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Duration of exercise</th>
<th>Work-related musculoskeletal disorders</th>
<th>n (%)</th>
<th>n (%)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30 minutes</td>
<td>Yes</td>
<td>45</td>
<td>11</td>
<td>16.833*</td>
<td>3</td>
<td>0.002</td>
</tr>
<tr>
<td>30 minutes to 1 hour</td>
<td>No</td>
<td>151</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than 1 hour</td>
<td>No</td>
<td>20</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.

The relationship between duration of exercise and work-related musculoskeletal disorders in the past 12 months was determined by using Chi-square test. Injured participants who did perform exercise less than 30 minutes were 75 (80.4%). There were 151 participants (79.5%) perform exercise for 30 minutes to 1 hour had work-related musculoskeletal disorders. Whereas injured participants who perform any exercise more than 1 hour were 20 (69.0%). There was an association between duration exercise and work-related musculoskeletal disorders among housewives. As there was significant difference in the work-related musculoskeletal disorders between exercise (p = 0.002).

Table 4.5.15: Association between stress level and work-related musculoskeletal disorders in the past 12 months.

<table>
<thead>
<tr>
<th>Stress level</th>
<th>Work-related musculoskeletal disorders</th>
<th>n (%)</th>
<th>n (%)</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low stress</td>
<td>Yes</td>
<td>62</td>
<td>29</td>
<td>3.249*</td>
<td>1</td>
<td>0.071</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>29</td>
<td>169</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Chi-square test was performed, df=degree of freedom, Level of significant at p<0.05.

The relationship between stress level and work-related musculoskeletal disorders in the past 12 months was determined by Chi-square test. Most of the participants having moderate stress were 169 (77.9%) whereas injured participants whom having low stress were 62 (68.1%). There was no statistically difference between work-related musculoskeletal disorders and exercise (p = 0.071). Thus, it shows no correspond between stress level and work-related musculoskeletal disorders.
V. DISCUSSION

5.1 Prevalence and characteristic of work-related musculoskeletal disorders

This is the first study of prevalence and risk factors of work-related musculoskeletal disorders among housewives in Selangor, Malaysia. The results of the study show that the prevalence of work-related musculoskeletal disorders among housewives was 75.0%. The prevalence of work-related musculoskeletal disorders in Malaysia is comparatively higher than the work-related musculoskeletal disorders rate was 40.9% in North India (Mishra et al., 2017). In contrary, Kalra & Bhatnagar (2017) indicated a higher prevalence which was 100% of housewife were affected by musculoskeletal disorders in Delhi and Noida of India. The contradictory of the result of studies might due to different environment, lifestyle, cultural and types of household activities which alter the present result.

In Malaysia, comparison of work-related musculoskeletal disorders between occupations can be done. A study of work-related musculoskeletal disorders among female non-healthcare working population in Selangor shown quite a similar rate (77.3%) compare to housewives in Selangor (Balakrishnan et al., 2016). Another study in 2004 showing higher prevalence rate (83.4%) of musculoskeletal problems among women assembly workers in the semiconductor industry (Chee & Rampal, 2004). This suggested that housewives having a similar probability of getting work-related musculoskeletal disorders as other occupations. Thus, awareness and treatment of work-related musculoskeletal disorders among housewives in Malaysia should be highly emphasized.

In the past 12 months, the main reported region of work-related musculoskeletal disorders was lower extremity, followed by axial region and upper extremity. The lower extremities including hip/ thigh, knee and feet/ ankle. The axial region including neck, upper back and lower back. The upper extremities including shoulder (left, right and both), elbow (left, right and both) and wrist/ hand (left, right and both). Overall, the most frequently injured body region of work-related musculoskeletal disorders among housewives in the past 12 months was lower back, followed by knee, feet/ ankle, neck, right of wrist/ hand, right shoulder, both of shoulder, upper back, hip/ thigh, right elbow, left shoulder, both of wrist/ hand, both of elbow and left elbow.

Since previous studies from other country were targeting among housewives, it is comparable to the past studies by Kalra & Bhatnagar (2017), Mishra, Srivastava and Srivastava (2015), Habib & Rahman (2015) and Fazli et al. (2014) and Golam Kibria (2012). Kalra & Bhatnagar (2017) found that the most frequently injured body region was lower back as similar as this study found. From the study by Mishra et al. (2015), the most common site for musculoskeletal disorders was found to be feet/ ankle among housewives. However, study from Habib & Rahman (2015) indicated that feet/ ankle was the least body region that encounters work-related musculoskeletal disorders. Habib and Rahman suggested that upper back was the most frequently affected body region causing work-related musculoskeletal disorders. In 2014, Fazli et al. (2014) conducted a study to determine the prevalence of musculoskeletal disorders among housewives. The result of the study indicated that back region was to be found as the highest prevalence of work-related musculoskeletal disorders among housewives. Golam Kibria (2012) also identified that 46% of respondents reported experiencing lower back pain.

As this study suggested that lower back was the most frequent region that caused work-related musculoskeletal disorders among housewives. There were previous studies specifically focus on investigating the prevalence of work-related musculoskeletal disorders among housewives in lower back region. Study of Gupta & Nandini (2015) suggested that there were 83% of respondents reported have low back pain. The study also show that more than 50% of housewives have severe disability due to low back pain. However, another study by Ranasinghe et al. (2016) indicated that the prevalence of household work-related musculoskeletal disorders in low back region among housewives was 36%. This antithetical result may be because of the different body parts of work-related musculoskeletal disorders caused by different types of household activities done.

From the result of this study, all of the participants that have work-related musculoskeletal disorders in the past 12 months were full-time housewife. The duration of participants being of housewife was more than 1 year. In the study of Habib & Rahman (2015), the population studied were women who engaging in regular household activities at a rural village of Bangladesh. Authors did not specify women who are full-time housewife or part-time housewife. This might alter the result of study due to external factor of being a part-time housewife. For example, a part-time housewife might be having other works that cause work-related musculoskeletal disorders. Specific inclusion criteria must be stated to ensure population were full-time housewife. So that, the data and information analyzed will be significant as housewife related musculoskeletal disorders.

Most of the participants who encounter work-related musculoskeletal disorders sought of medical treatment to solve their problems. However, there was only 4.9% of participants seek for physiotherapy treatment to reduce their musculoskeletal problems. The result was comparative low compared to the study of Golam Kibria (2012). In the study of Golam Kibria (2012), among the participants 21% of them have taken physiotherapy treatment for their work-related musculoskeletal disorders. Moreover, the prognosis of physiotherapy treatment was 100% good for them. The acknowledgement of physiotherapy treatment to housewives in Malaysia should be increased. As proven in study of Golam Kibria (2012), physiotherapy treatment had provided a good prognosis to work-related musculoskeletal disorders among housewives.

In the current study, authors found 75% of prevalence of work-related musculoskeletal disorders among housewives in Selangor, Malaysia. The most common site of work-related musculoskeletal disorder among housewives in the past 12 months was lower back, knee and foot/ ankle region. The common site that prevented their normal work during the past 12 months was shoulder, knee and neck region.

5.2 Risk Factors of Work-related Musculoskeletal Disorders
There were numerous potential risk factors that caused work-related musculoskeletal disorders among housewives. Those risk factors were the tasks that might increases the likelihood of developing work-related musculoskeletal disorders among housewives. The main risk factors can be categorized into individual factors, psychosocial factors and physical factors.

Regarding the individual factors study in this study, there were age, ethnicity, highest level of education attained and the number of children. Height and weight of participants did not study in this study due to those factors are proven by the study of Sallehuddin et al. (2018). This study was conducted among housewives in Malaysia. The authors had suggested that overweight and obese housewives considered as a high-risk group for getting musculoskeletal pain. Another study by Mishra et al. (2015) also indicated that overweight or obese puts extra weight on muscles which caused musculoskeletal disorders. Thus, overweight and obese housewives which perform household activities might raise the chance of getting work-related musculoskeletal disorders.

For age factor, there was a significant association between age and work-related musculoskeletal disorders among housewives in Selangor, Malaysia. The age range which has the highest number of participants of getting work-related musculoskeletal disorders was 41 to 45 years. For my point of view, there are reduce of muscle mass and bone density by aging and with multiple household activities will increase the fatigue rate of muscle which leads to work-related musculoskeletal disorders. This was supported by Sallehuddin et al. (2018) that older obese housewife had higher risk of getting musculoskeletal disorders compared to a young obese housewife. The finding of Mishra et al. (2015) also supported that age was the risk factor of musculoskeletal pain. The authors targeted homemakers who aged between 26 to 65 years. Another study by Fazli et al. (2014) also targeted housewives who aged between 20 to 65 years and suggested that the prevalence of pain and disorders increase with the increasing of age. However, in the current study, the targeted population of housewives in Selangor, Malaysia was between 18 to 50 years only. This is because to prevent any others data collection of work-related musculoskeletal disorders that caused by menopause. As hormonal change during menopause will increase the causes of musculoskeletal disorders. There was study suggested that women who experienced postmenopausal are having a higher prevalence of getting musculoskeletal symptoms compared to premenopausal women (Gao et al., 2013). Thus, the age limit of this study was 50 years due to the average age of menopause in Malaysia was 50.7 years (Abdullah et al., 2017).

In the current study, the difference in the work-related musculoskeletal disorders between ethnicity was not statistically significant. This is due to more Chinese participants were taking part in current study. Thus, the finding result might be altered. There was few study determine the association between ethnicity and work-related musculoskeletal disorders. In 2012, Dham et al. conducted a study to describe the relationship between work-related musculoskeletal disorders and ethnicity in different parts of the world. The authors suggested that the burden of work-related musculoskeletal disorders is likely to vary in different parts of the world. They also indicated that disease health process in cultural and is influenced by socioeconomic factors. Thus, there is no specific relationship between ethnicity and work-related musculoskeletal disorders among housewives. However, more studies are needed to evaluate the risk of work-related musculoskeletal disorders among different ethnicities in the nation.

Notably, there was no association between the education level that obtained and work-related musculoskeletal disorders. This might due to high technology nowadays, a person with high or low education level is able to browse internet and search information for their particular work-related musculoskeletal disorders. This result differed from the study by Fazli et al. (2014) that low education level increases the prevalence of work-related musculoskeletal disorders. In contradictory, the author suggested that subjects who have a high educational degree have got more information about ergonomic issues and keeping body in proper posture from different sources compare to subjects who have low educational level. Regarding this factor, further research should be carried out so that the result would be valuable in assessing the relationship between education level that obtained and work-related musculoskeletal disorders.

The difference between the work-related musculoskeletal disorders in the past 12 months and number of children was not statistically significant. Current study showed no association between number of children and work-related musculoskeletal disorders among housewives. There are several factors that alter the result like the age range of participants in current study and the age of their children. As in the majority of age range within 41 to 45 years, their number of children probably will not show much effect on their work-related musculoskeletal disorders. Whereas, the age of their children will more effect to their work-related musculoskeletal disorders as younger children needs more care like carrying children around. However, several studies had revealed otherwise. A study that conducted among 296 housewives found that women with children have higher chances to develop work-related musculoskeletal disorders around neck and shoulder region compare to single women with no children. This is also supported by Fazli et al. (2014) that work-related musculoskeletal disorders is associated with the number of children among housewives. Further studies should be done to investigate the association between the number of children and specific age group of housewives.

Regarding the duration in performing household activities, there shown an association with work-related musculoskeletal disorders. The percentage of getting work-related musculoskeletal disorders increased with the increasing of duration of household activities. As prolonged period of repetitive movement of household activities will increase the muscle fatigue and also increase the physical stress to body parts. The highest frequency of getting work-related musculoskeletal disorders was 3 to 4 hours of household activities each day. Based on this duration, there was a study specifically conducted among women that involved in household activities for at least 5 hours a day. Habib & Rahman (2015) found that among them, the prevalence rate of musculoskeletal pain was considerably high (68.49%). Ranasinghe et al. (2016) indicated that 36% of housewives had household related musculoskeletal disorders in low back region were participated themselves for at least 4 hours of household activities for 5 days in a week. From reviewing the literature of study of Kalra & Bhatnagar (2017), increased hours of household activities at home was the finding of risk factor caused work-related musculoskeletal disorders. Prolonged duration of household activities with an insufficient resting period was the risk factor of work-related musculoskeletal disorders.
For the types of household activities that performed among housewives, there shown no direct association with work-related musculoskeletal disorders. This might due to the single factors of types of household activities does not directly cause work-related musculoskeletal disorders. Whereas, with the combination of individual factors, duration of work and physical stress obtained by household activities will cause work-related musculoskeletal disorders. Previous studies from Kalra & Bhatnagar (2017) and Dhone & Khare (2017) supported that reason of getting work-related musculoskeletal disorders could be biomechanical features of household like cleaning at home and cooking. In relation to washing, Dhone and Khare (2017) proposed that ergonomic and work-related musculoskeletal disorder among housewives was greatly determined by the type of activities which housewives performed. In order to focus on work-related musculoskeletal disorders in low back region, Ranasinghe et al. (2016) advocated that majority housewives that had work-related musculoskeletal disorder were performing multiple of household activities which conceptualized with physical exposures which related to. Even it has shown no direct relationship of types of household activities and work-related musculoskeletal disorders in this study, there were alternative studies shown contradictory among them. Thus, further study should proceed to justify the relationship between types of household activities and work-related musculoskeletal disorders.

The difference in the work-related musculoskeletal disorders between exercise was statistically significant. There was a negative correlation shown between both variables. This means that the increasing of performing exercise will reduce the work-related musculoskeletal disorders. 78% of participants that are did not encounter work-related musculoskeletal disorders claimed that they did perform exercise. However, 93.5% of them have work-related musculoskeletal disorders also claimed that they did perform exercise. Half of the participants did walked as their exercise activity. Yet, walking shows highest percentage of participants encounter work-related musculoskeletal disorders. The intensity of walking is not clearly stated by the participants, thus the intensity of exercise is the factors that affect the effectiveness of work-related musculoskeletal disorders. This might explain the contradictory of participants that performed exercise still getting work-related musculoskeletal disorders. A literature reviewed from Gasibat et al. (2017) suggested that there was no complete interpretation shows work-related musculoskeletal disorders can be prevented from performing stretching during work. Nonetheless, Freitas-Swerts & Robazzi (2014) that there was a statistically significant of in reducing pain of body parts with exercise program. There were some studies indicated that discomfort and pain of musculoskeletal disorders can be reduced by performing stretching exercises during working time. Further studies might needed to clearly clarify the importance of exercises to work-related musculoskeletal disorders.

In current study, the duration of exercise is associated with work-related musculoskeletal disorders. It showed a negative correlation which means that the increased of duration of exercise will dwindle the work-related musculoskeletal disorders. This is due to increasing duration of exercise did increase the flexibility, strength and mass of muscle. Muscle and bones which are strong enough will reduce the risk of work-related musculoskeletal disorders. The finding of Rodrigues et al. (2014) supported that exercised with high intensity, three times a week for 20 minutes could reduce work-related musculoskeletal pain in workers. However, previous studies were not emphasized about the relationship between exercise and its duration to work-related musculoskeletal disorders among housewives.

On regard to psychosocial factor, it was shown no association between stress level and work-related musculoskeletal disorders. The result might due to less psychosocial effect toward work-related musculoskeletal disorders among housewives. The stress caused by psychological workloads is not severe enough to cause tension of muscle that leads to work-related musculoskeletal disorders. Furthermore, housewives who having low or moderate stress have their own method to release their stress that will not further leads to work-related musculoskeletal disorders. A study of psychosocial factors on work-related musculoskeletal disorders among Southeastern Asian female workers in Korea was also unsuccessful to confirm the relationship between psychosocial factors and workloads (Lee et al., 2011). In contrast, a cross-sectional study among nurses provided an indication of the relationship between work environment stress levels and musculoskeletal disorders (Dehdashht et al., 2017). The result was in agreement of previous literature suggesting that role related stress are highly frequent in a variety of occupations. Oludele (2015) also shows among office worker, stress level having a great potential in causing pain in different parts of the body. In fact, high stress level of workers have corresponded with pain in different parts of body of participants and musculoskeletal disorders. A more precise method should be carry out in further study to investigate the relationship between stress level and work-related musculoskeletal disorders.

In current study, the association between types of household activities and different parts of body that encounter work-related musculoskeletal disorders was determined. There was no previous research study about the association between them. However, a study of Bihari et al. (2013) had determined the routine activities of housewives and the possible physical stress. With the same method, the possible physical stress of household activities among housewives had determined. Sweeping included the involvement of hands and bending of trunk together with whole body muscular movement while standing. Mopping involved more force of hands and bending of trunk together with whole body muscular movement while standing. Washing involved of hands, arms and back muscles for washing clothes. Cooking required the involvement of bending and stretching of arm for cooking and leg muscles for prolonged standing. Whereas, grocery shopping required the involvement of upper limbs which requires more force and increase load of trunk. Parental care which included the involvement of shoulder and trunk which requires a lot of muscular movement. With the possible physical stress, it is able to explain the relationship of the different types of household activities and body parts that encounter work-related musculoskeletal disorders.

For neck region of work-related musculoskeletal disorders, the most household activities done was cooking. Sweeping and mopping were also frequently done by housewives which had neck work-related musculoskeletal disorders. Cooking, sweeping and mopping that required awkward position of neck to bend for a period will caused neck pain. Besides these three types of household activities that might cause neck work-related musculoskeletal disorders, washing was also suggested by Habib & Rahman (2015). The authors reported necks remained bent more than 45 degrees and those movements were repetitive while performing sweeping, cooking.
and washing clothes. Mishra et al. (2015) indicated that women with children tend to develop neck problem due to a long period of parental care. Household activities like sweeping, mopping, washing, cooking and parental care were involved in the neck work-related musculoskeletal disorders.

The most frequent household activity performed by housewives which involved in right, left and both shoulder work-related musculoskeletal disorders was cooking. Since cooking involved repetitive movement of bending and stretching of arm for a prolonged period. This supported by a study of Dhone and Khare (2017) that pulling and pushing while cooking will be caused shoulder pain. For pulling and pushing of arm during household activity, sweeping and mopping fulfill the criteria. Current study also showed that sweeping and mopping were the more frequently performed household activities after cooking. Fong & Law (2008) also suggested that grocery shopping will cause shoulder pain due to heavy lifting of loads. For shoulder work-related musculoskeletal disorders, the involvement of household activities was sweeping, mopping, cooking and grocery shopping.

Regarding the part of elbow work-related musculoskeletal disorders, the overall most frequent household activity did by housewives were sweeping and cooking. This is due to repetitive movement of bending and stretching of elbow while they performing those household activities. Habib & Rahman (2015) investigated that household activities like cooking, washing and sweeping consisted of repetitive elbow movement. Coffin (2013) supported that repetitive movement of work will cause work-related musculoskeletal disorders. Sweeping, cooking and washing that regularly performed by housewives were highly caused of elbow work-related musculoskeletal disorders.

For wrist/ hand work-related musculoskeletal disorders, cooking was the most frequently performed household activity among housewives. Habib & Rahman (2015) also suggested that cooking for more than 6 hours per day was associated with work-related musculoskeletal disorders in wrist region. However, sweeping was also found in current study and study of Habib & Rahman. As wrist/ hand region is mostly used for any activities of daily living among anyone, housewives who perform household activities daily will reduce the resting period of their wrist/ hand. Based on a journal from European Agency for Safety and Health at work, household activities with insufficient rest period is a kind of risk factor that can cause leading of getting work-related musculoskeletal disorders. Cooking and sweeping can considerable as the household activities that boosting up the hazard of wrist/ hand work-related musculoskeletal disorders.

There was only few studies determine the relationship between household activities and upper back work-related musculoskeletal disorders. In 2008, Fong & Law suggested that there was an association between upper back pain and shopping. Authors claimed that repetitive carrying of heavy loads will affect both upper back and shoulder. However, in current study cooking was the most frequently done household activity among upper back pain housewives. This might due to awkward posture of bending their trunk when they performed cooking. Further study can be done to clarify the effect of household activities on upper back work-related musculoskeletal disorders.

Regarding the most frequently injured body part, lower back work-related musculoskeletal disorders, there were several studies could be compared to current study. In the current study, the most frequent household activity done was cooking. While performing cooking, they always in awkward posture of bending their trunk. Habib & Rahman (2015) also supported that cooking which involved awkward posture of back bent forward more than 45 degrees will cause lower back pain. The authors further suggested that washing and sweeping will place housewives in an awkward posture. Working in awkward postures is one of the physical factors that associated with work-related musculoskeletal pain (Habib et al., 2015). Another study by Kalra & Bhatnagar (2017) indicated that parental care like heavy lifting of children whom over 10kg correlated with low back disorders. Thus, the combination of suggestion in current and previous study shows that sweeping, washing and cooking have a higher chance to cause upper back work-related musculoskeletal disorders.

For hip/ thigh work-related musculoskeletal disorders, current study shows that sweeping was the most frequent household activity performed among hip/ thigh injury housewives. This might due to prolonged awkward posture of bending while sweeping. Another reason will be caused by radiating from the lower back pain. There were only study of Fong & Law (2008) investigated that self-perceived hip/ thigh pain was more likely occur when performing washing. Authors also show there was an association between hip/ thigh work-related musculoskeletal disorders and washing utensils. Since there was contradictory of findings, further study on types of household activities and hip/ thigh work-related musculoskeletal disorders should be carried out.

Regarding knee work-related musculoskeletal disorders, current study shows cooking was the most frequent performed household activity. However, study of Habib & Rahman (2015) suggested that household activity which required squatting position like cooking on ground level burner will cause knee WMSDs increase the risk of knee injury. Awkward posture like squatting for prolonged period is known to be risk factor for knee disorders suggested by Ditchen et al. (2014). However, ergonomics design for stove level nowadays is rarely at ground level. Thus, knee work-related musculoskeletal disorders in current study might due to other factors like aging. Any types of household activities which required squatting should be precisely further investigate to determine the association of knee work-related musculoskeletal disorders.

According to the feet/ ankle work-related musculoskeletal disorders, mopping and sweeping were found that more performed among housewives compare to other types of household activities. Mopping and sweeping required prolonged period of standing which might cause feet/ ankle work-related musculoskeletal disorders. Study of Adbus et al. (2016) supported that prolonged standing can cause sore feet and swelling of the legs. However, further study should be done to more investigate the effect of household activities towards feet/ ankle musculoskeletal disorders.

In the current study, there was some potential risk factor like individual and physical factor corresponded with work-related musculoskeletal disorders among housewives. Individual factor like age, duration of household activities, exercise and duration of
exercise were related to work-related musculoskeletal disorders among housewives. Physical factors like repetitive movement, awkward posture, heavy lifting and prolonged activity with insufficient of rest period were related to work-related musculoskeletal disorders among housewives. However, psychosocial factor like stress level among housewives was failed to confirm its relationship with work-related musculoskeletal disorders. Furthermore, there shown that there was no significant association in work-related musculoskeletal disorders regarding ethnicity, education level obtained, number of children, types of household activities and domestic help.

5.3 Limitations

There were several limitations in this study. In methodology, author used convenience sampling method. While recruiting the participants, the sampling method used might consisting of sample bias. Thus, the biased results might not be truly represented the whole population. In additional, the author did not reached the sample size of 368 participants in this study. The study was limited to the area of Selangor only. As the findings of study may not generalized to all the housewives in Malaysia. There was duration limitation on this study. Author had time limitation on recruiting 368 participants to take part in this study. There was only 4 weeks to recruit the total number of participants.

5.4 Recommendations

In future studies, a larger sample size is recommended in order to achieve more accurate and precise result of the prevalence and risk factors of work-related musculoskeletal disorders among housewives. The generalizability of the study can be increased by using random sampling method among those targeted population.

Future studies can also investigate more detailed information toward household activities. For example, the duration of each kind of household activities that performed, duration of perform household activities in a week and duration of getting rest from household activities.

Those potential risk factors that are not proven their association with work-related musculoskeletal disorder in current study can be further determined in further study. A better method should be used to investigate those risk factors with work-related musculoskeletal disorders.

A more precise method can used to determine the stress level among housewives. As perceived stress scale obtained only ten questions to investigate the stress level of housewives. A more detailed questionnaire should be used to determine stress level and associated with work-related musculoskeletal disorders.

The setting of study should equally include all the state of Malaysia, so that the result can be generalised to the whole population of housewives in Malaysia.

To resolve the problem of time limitation on this study, the duration of data collection should be slightly increase to a long period. This is in order to have enough time to recruit the total number of sample size for the study.

VI. CONCLUSIONS

The prevalence of work-related musculoskeletal disorders among housewives is as high compared to other occupations. Therefore, awareness and medical attention for housewives regarding work-related musculoskeletal disorders must be highly concerned and emphasized. The potential risk factor associated with work-related musculoskeletal disorders were age, height, weight, duration spending on household activities, exercise and duration of performing exercise. While these potential risk factors are found to be associated, further investigation into finding the causal relationships is required. The potential risk factors should be highly avoided to scale down the risk of work-related musculoskeletal disorders. Housewives that performed several household activities is necessary to be disseminate the awareness to perform with sufficient rest period and avoid those possible risk factors which might impact any injury of body parts. By reducing the work-related musculoskeletal disorders, housewives can enjoy their healthy life without any discomfort with their family.

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APPENDIX D

Questionnaire

(English Version)

Prevalence and Risk Factor of Work-related Musculoskeletal Disorders among Housewives Questionnaire

Please put tick (✓) in the given boxes.

Part- A: Socio-demographic information.

Name: ____________________________

1. Age:
   □ 18-24 years
   □ 25-30 years
   □ 31-35 years
   □ 36-40 years
   □ 41-45 years
   □ 46-50 years

2. Ethnicity:
   □ Malay
   □ Chinese
   □ Indian
   □ Others: ____________________

3. Educational status:
   □ Primary education
   □ Secondary education
   □ Tertiary education
   □ Others: _____________________
4. Please tick the suitable option:
- Housewife → Proceed to Question 5
- Working woman → End of question

5. Duration of being housewife:
- Less than 1 year
- More than 1 year

6. Number of children: __________

Part-B: Risk identification.

1. On an average, how many hours you work on household activities every day?
- Less than 1 hour
- 1-2 hours
- 3-4 hours
- 5-6 hours
- 7-8 hours
- More than 7 hours

2. What types of work you are doing during household activities? (You can select more than one option.)
- Sweeping
- Mopping
- Washing
- Cooking
- Parental care
- Grocery shopping
- Other: (please specify)________________________

3. Do you have any domestic help?
- Yes
- No (Skip question 6)

4. What type work that domestic work helps you? (You can select more than one option.)
- Sweeping
- Mopping
- Washing
☐ Cooking  
☐ Parental care  
☐ Grocery shopping  
☐ Other: (please specify)________________________

5. Do you exercise?  
☐ Yes  
☐ No (Skip question 8 & 9)

6. What kind of exercise do you do?  
(You can select more than one option.)  
☐ Walking  
☐ Jogging  
☐ Swimming  
☐ Cycling  
☐ Yoga  
☐ Other: (please specify)________________________

7. How long do you perform the exercise?  
☐ Less than 30 minutes  
☐ 30 minutes to 1 hour  
☐ More than 1 hour

8. Have you taken any medical treatment for household related musculoskeletal problems?  
☐ Yes  
☐ No

9. Have you taken any physiotherapy treatment for household related musculoskeletal problems?  
☐ Yes  
☐ No
Perceived Stress Scale
The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Fairly Often</th>
<th>Very Often</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In the last month, how often have you been upset because of something that happened unexpectedly?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2. In the last month, how often have you felt that you were unable to control the important things in your life?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3. In the last month, how often have you felt nervous and “stressed”?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. In the last month, how often have you felt confident about your ability to handle your personal problems?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. In the last month, how often have you felt that things were going your way?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. In the last month, how often have you found that you could not cope with all the things that you had to do?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7. In the last month, how often have you been able to control irritations in your life?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8. In the last month, how often have you felt that you were on top of things?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9. In the last month, how often have you been angered because of things that were outside of your control?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Part-C: Site of disorder.

1. Do you have any pain or discomfort?
   - Yes
   - No (Skip question 2)
2. The table below relates to musculoskeletal symptoms questions.

<table>
<thead>
<tr>
<th>Site</th>
<th>Have you at any time during the last 12 months had trouble (ache, pain, discomfort, numbness) in:</th>
<th>Have you had any time during the last 12 months been prevented from doing your normal work (at home or away from home) because of the trouble?</th>
<th>Have you had trouble at any time during the last 7 days?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes □ Yes</td>
<td>□ No □ Yes □ Yes</td>
</tr>
<tr>
<td>Shoulder</td>
<td>□ No □ Yes, side: (left/ right/ both)</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
</tr>
<tr>
<td>Elbow</td>
<td>□ No □ Yes, side: (left/ right/ both)</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
</tr>
<tr>
<td>Wrist/Hand</td>
<td>□ No □ Yes, side: (left/ right/ both)</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
</tr>
<tr>
<td>Upper back</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
</tr>
<tr>
<td>Lower back</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
</tr>
<tr>
<td>Hip/Thigh</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
</tr>
<tr>
<td>Knee</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
</tr>
<tr>
<td>Foot/Ankle</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
<td>□ No □ Yes</td>
</tr>
</tbody>
</table>
APPENDIX F

Online Questionnaire

Prevalence and Risk Factors of Work Related Musculoskeletal Disorders among Housewives

1. You are invited to participate in a research titled “Prevalence and risk factors of work-related musculoskeletal disorders among housewives”. This study is being conducted by Choong Bel Ying, a student from Department of Physiotherapy, Faculty of Medicine and Health Sciences from Universiti Tunku Abdul Rahman. The purpose of this study is to investigate the prevalence and risk factor of work-related musculoskeletal disorders among housewives. The information gathered during this study will remain confidential in secure premises during this project. There are no risks or discomfort that are anticipated from your participation in the study. Participation in this study is voluntary. You have the right not to participate at all or to leave the study at any time. This questionnaire takes approximately 5 minutes to complete. If you have any questions regarding this study, please don’t feel hesitate to contact me. Choong Bel Ying (019-4723135 / bel_1123@hotmail.com). If you have understood and agree with the statement above and wish to participate in this survey, please select Agree. Your participation is appreciated.

Mark only one oval.

☐ Agree
☐ Not Agree

2. Name *

3. Date

Example: December 15, 2012

Socio-demographic information

4. 1. Age

Mark only one oval.

☐ 15-24 years
☐ 25-30 years
☐ 31-35 years
☐ 36-40 years
☐ 41-45 years
☐ 46-50 years

5. 2. Ethnicity

Mark only one oval.

☐ Malay
☐ Chinese
☐ Indian
☐ Other:

https://docs.google.com/forms/d/1RvxsR4sL9S7XJ6h06-iwC/hk/e3a9SRIAf0MARKVc/edit
6. 3. Educational status

Mark only one oval:
- Primary education
- Secondary education
- Tertiary education
- Other: __________________________

7. 4. Please choose the suitable option:

Mark only one oval:
- Housewife
- Working women (Skip question 5)

8. 5. Duration of being housewife:

Mark only one oval:
- Less than 1 year
- More than 1 year

9. 6. Number of children

Risk identification.

10. 1. On an average, how many hours you work on household activities every day?

Mark only one oval:
- Less than 1 hour
- 1-2 hours
- 3-4 hours
- 5-6 hours
- 7-8 hours
- More than 8 hours

11. 2. What types of work you are doing during household activities? (You can select more than one option.)

Check all that apply:
- Sweeping
- Mopping
- Washing
- Cooking
- Parental care
- Grocery shopping
- Other: __________________________
12. 3. Do you have any domestic help? 
   Mark only one oval.
   - Yes
   - No

13. 4. What type work that domestic work helps you? (You can select more than one option.)
   Check all that apply:
   - Sweeping
   - Mopping
   - Washing
   - Cooking
   - Parental care
   - Grocery shopping
   - Other: ____________________________

14. 5. Do you exercise regularly?
   Mark only one oval.
   - Yes
   - No

15. 6. What kind of exercises? (You can select more than one option.)
   Check all that apply:
   - Walking
   - Jogging
   - Swimming
   - Cycling
   - Yoga
   - Other: ____________________________

16. 7. How long do you perform the exercise?
   Mark only one oval.
   - Less than 30 minutes
   - 30 minutes to 1 hour
   - More than 1 hour

17. 8. Have you taken any medical treatment for household related musculoskeletal problems?
   Mark only one oval.
   - Yes
   - No
18. Have you taken any physiotherapy treatment for household related musculoskeletal problems?
   Mark only one oval.
   [ ] Yes
   [ ] No

Perceived Stress Scale
The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

19. In the last month, how often have you been upset because of something that happened unexpectedly?
   Mark only one oval.
   [ ] 0
   [ ] 1
   [ ] 2
   [ ] 3
   [ ] 4
   Never
   Very Often

20. In the last month, how often have you felt that you were unable to control the important things in your life?
   Mark only one oval.
   [ ] 0
   [ ] 1
   [ ] 2
   [ ] 3
   [ ] 4
   Never
   Very Often

21. In the last month, how often have you felt nervous and “stressed”?
   Mark only one oval.
   [ ] 0
   [ ] 1
   [ ] 2
   [ ] 3
   [ ] 4
   Never
   Very Often

22. In the last month, how often have you felt confident about your ability to handle your personal problems?
   Mark only one oval.
   [ ] 0
   [ ] 1
   [ ] 2
   [ ] 3
   [ ] 4
   Never
   Very Often

23. In the last month, how often have you felt that things were going your way?
   Mark only one oval.
   [ ] 0
   [ ] 1
   [ ] 2
   [ ] 3
   [ ] 4
   Never
   Very Often

https://docs.google.com/forms/d/1RvvjR4sLREjXhD6xWChkK2Zv73hES5R1AdQ1kCTyW/edit
Prevalence and Risk Factors of Work Related Musculoskeletal Disorders among Housewives

24. In the last month, how often have you found that you could not cope with all the things that you had to do?  
Mark only one oval.

0 1 2 3 4

Never □ □ □ □ □ Very Often

25. In the last month, how often have you been able to control irritations in your life?  
Mark only one oval.

0 1 2 3 4

Never □ □ □ □ □ Very Often

26. In the last month, how often have you felt that you were on top of things?  
Mark only one oval.

0 1 2 3 4

Never □ □ □ □ □ Very Often

27. In the last month, how often have you been angered because of things that were outside of your control?  
Mark only one oval.

0 1 2 3 4

Never □ □ □ □ □ Very Often

28. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?  
Mark only one oval.

0 1 2 3 4

Never □ □ □ □ □ Very Often

Site of disorder

29. Do you have any pain or discomfort?  
Mark only one oval.

□ Yes □ No

30. Have you at any time during the last 12 months had trouble (ache, pain, discomfort, numbness)*  
Mark only one oval.

□ Yes □ No
31. 3. Which area of body? (You can select more than one option.)
   Check all that apply.
   - Neck
   - Shoulder (Left)
   - Shoulder (Right)
   - Shoulder (Both)
   - Elbow (Left)
   - Elbow (Right)
   - Elbow (Both)
   - Wrist/Hand (Left)
   - Wrist/Hand (Right)
   - Wrist/Hand (Both)
   - Upper back
   - Lower back
   - Hip/Thigh
   - Knee
   - Foot/Ankle

32. 4. Have you had any time during the last 12 months been prevented from doing your normal work (at home or away from home) because of the trouble?
   Mark only one oval.
   - Yes
   - No

33. 5. Which area of body? (You can select more than one option.)
   Check all that apply.
   - Neck
   - Shoulder
   - Elbow
   - Wrist/Hand
   - Upper back
   - Lower back
   - Hip/Thigh
   - Knee
   - Foot/Ankle

34. 6. Have you had trouble at any time during the last 7 days?
   Mark only one oval.
   - Yes
   - No

35. 7. Which area of body? (You can select more than one option.)
   Check all that apply.
   - Neck
   - Shoulder
   - Elbow
   - Wrist/Hand
   - Upper back
   - Lower back
   - Hip/Thigh
   - Knee
   - Foot/Ankle
Basic Stretching from Head to Toes
Student Consumptive Behavior Based on Intensity of Using Non-Cash Transactions

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10783

Abstract-This study aims to measure student consumption behavior by shopping scores. Researchers also looked at the relationship between the intensity of the use of banking services and electronic money on shopping behavior. Data was collected from 487 students at the University of Indonesia from various majors. The data that has been filled is analyzed by converting a Likert value to a score of 0-100. Furthermore, this study uses descriptive analysis, crosstables, and One-Way Anova. Based on the results, the average UI students shopping scores were 66.48, including the medium (33.34-66.66). There is a very significant difference between men's and women's shopping scores (p-value = 0.0000363). The Women's shopping scores (67.79) are higher by 3.43 points than men's shopping scores (64.36). Women's shopping scores are in the high category, while men's shopping scores are in the moderate category. High shopping behavior is also influenced by the intensity of the use of banking services and electronic money. Based on the one-way ANOVA test, there is a very significant influence on the intensity of the use of banking services (p = 0.000) and the use of electronic money (p = 0.000) on shopping scores. Students who have electronic money have a trend to shop compared to students who do not have electronic money. Likewise, students who frequently use banking services (ATMs, debit cards, credit cards) tend to prefer shopping to students who have never or rarely used them.

Index Terms-consumption, shopping, electronic money, and banking services

I. INTRODUCTION

Consumptive behavior is always interesting to research, this is because excessive consumption will negatively impact financial management in a person. Consumption includes the purchase of goods or services used to meet the needs of life. Nowadays, consumer behavior is not only for everyday needs but more to life satisfaction. The same has been examined by Tama (2014) which states the understanding of consumption as expenditure for obtaining goods and services to satisfy or meet the needs.

Goods and services are obtained through purchase which is one of the activities in the transaction. In his research, Amarjit Gill and Charul (2012), evaluating the use of money for daily transactions in meeting needs can be done by spending money to get services or consumer goods. In this era, there was a shift (shift) in people's habits in the transaction. People began to recognize tools for payment other than banknotes/coins.

In general, people in Indonesia conduct transactions in 2 ways, namely by cash and non-cash. Before there is a non-cash transaction, according to Gosal and Linawati (2018), if one is going to make a large transaction, one must carry a large container. This is of course very different from the transactions that are happening today. Transaction activities have become very easy with the help of technology. Technological developments create a more practical method of payment, in the transaction only need to use a cell phone or a card.

Innovation in the digital era encourages the financial industry to participate in the release of products that can be taken by the community. According to Candrawati (2014), the non-cash payment tools used by the public are generally issued by banks and other institutions. The payment instrument issued by the bank is a credit card (debit card). While the instrument of payment issued by another institution is called the Stored Value Card, this card is known as Electronic Money (e-money). In its use e-money is used for
The government likes to make campaigners about the non-cash transaction. The sharing of research has been researched about the readiness of the community using a non-cash payment tool including research by tazkiyyaturrohmah (2018) and Jati (2015). The Government forms a non-cash society or often known as the term cashless Society. This Movement is effective for encouraging the economy of a more Efficient country (Tee, 2017). The Socialization and campaign of electronic money-based card technology is a policy issued by Bank Indonesia (BI) since the year 2006. On 14 August 2014, the government socialized the National Noncash Movement (GNNT) which aims to use transactions electronically and minimize cash usage.

GNNT is widely responded positively by the Indonesian community, including students. GNNT also triggered a change in the consumer's twists among students. Octavian's research (2016) stated that students at Surabaya State University would prefer to shop online with a CASH transfer payment instrument. Any change in the accounting behavior of the development of technology has always had a positive and negative impact, a study discussing the negative effects of this technology include Sham (2015). In his research, Sham stated that teenagers are still more likely to be consumptive with irrational reasons just because they are affected by advertising, friend calls, massive discounts, etc. Likewise, the first semester students around 18-19 years old are still very prone to consumptive behavior.

II. MATERIALS AND METHODS

Data in research is the primary data that is obtained directly by spreading the questionnaire to the student who is the sample. The student age range sampled is 17-19 years old (first-rate students). The variables used include two latent variables i.e. the use of banking/electronic money and shopping services, in which each indicator can be seen in table 1. Respondents were asked to fill the questionnaire that was disseminated with the chosen category never (1), rarely (2), and often (3).

Table 1. Latent variables and indicators

<table>
<thead>
<tr>
<th>Latent variables</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Cash transactions</td>
<td>I transact using banking services (ATM, debit card, credit card, mobile payment, etc.)</td>
</tr>
<tr>
<td></td>
<td>I have money in my electronic Bank (like OVO, E-money, etc.)</td>
</tr>
<tr>
<td></td>
<td>I compare prices between stores/supermarkets/supermarkets before making a purchase</td>
</tr>
<tr>
<td></td>
<td>I bought the product due to the discount</td>
</tr>
<tr>
<td></td>
<td>I bought the goods that fit the needs</td>
</tr>
<tr>
<td></td>
<td>I bought the item because it affected ads</td>
</tr>
<tr>
<td></td>
<td>I bought the item because of the desire spontaneously</td>
</tr>
<tr>
<td></td>
<td>I bought items because of my friend's influence</td>
</tr>
</tbody>
</table>

Based on the data source from Forlap Dikti (https://forlap.ristekdikti.go.id), the number of students in the year 2018/2019 active at 46,378 students. Draw samples using simple random methods. Based on the calculation results of the sample count with the formula Slovin, the margin of error 5%, the number of samples produced is 397 respondents. In this research, the questionnaire was distributed to 487 students, so that it was following the minimum sample based on the formula Slovin.

The Data that has been collected is tested for validity and reliability. Validity testing with Pearson correlation to equation 1. The indicator is valid if Significant is correlated with the total score indicator. Equation 2 is the formula for reliability testing.
Statistics of reliability test using alpha Conbrach. If the value of Cronbach Alpha > 0.60, then it can be said to be reliable (Straub, 2004). Subsequent testing with descriptive statistics: Bar charts, pie charts, and cross tables to see the characteristics of respondents. This research uses the 3 initial hypotheses to be tested.

**Hypothesis 1**

A one-way T-test statistic is used to test the hypothesis that women have a higher shopping score than men. These test statistics are used in two unpaired (independent) populations assuming the same variance/variety.

H<sub>0</sub>: Men have the same shopping score with less than women's shopping scores  
H<sub>1</sub>: Women have higher shopping scores than men

**Hypothesis 2**

Test One Way Anova/Variegated One way analysis is used to test if there is a difference between students who never, rarely, and often use banking services against the shopping score.

H<sub>0</sub>: Each student group's shopping score is equal  
H<sub>1</sub>: At least one group of students who have different shopping scores.

**Hypothesis 3**

The 3rd hypothesis is the use of electronic money. Anova One way is also used to test if there is a difference between students who do not have e-money, rarely use, and often use e-money towards shopping scores.

H<sub>0</sub>: Each student group's shopping score is equal  
H<sub>1</sub>: At least one group of students has different shopping scores.

### III. RESULTS AND DISCUSSION

**Validity and reliability**

Validity testing is performed in each of the latent variables used in this study. Table 2 shows the outcome of the validity test the second indicator is valid. Reliability testing with Conbrach's Alpha, α value α*=0. 805 > 0.6, it can be inferred.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>R</th>
<th>P-value</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>X&lt;sub&gt;1&lt;/sub&gt;</td>
<td>0869</td>
<td>0.000* *</td>
<td>Valid</td>
</tr>
<tr>
<td>X&lt;sub&gt;2&lt;/sub&gt;</td>
<td>0651</td>
<td>0.000* *</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Significant at Alpha 0.01

The validity test for the latent shopping construct is shown in table 3. Based on the test results All indicators are declared valid. Conbrach's Alpha value, α*= 0663 > 0.6, it can be said that it is reliable. The tested variable indicator has qualified validity and reliability so that it can be used for further analysis.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>R-Value</th>
<th>P-value</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y&lt;sub&gt;1&lt;/sub&gt;</td>
<td>0.569</td>
<td>0.000* *</td>
<td>Valid</td>
</tr>
<tr>
<td>Y&lt;sub&gt;2&lt;/sub&gt;</td>
<td>0.439</td>
<td>0.000* *</td>
<td>Valid</td>
</tr>
<tr>
<td>Y&lt;sub&gt;3&lt;/sub&gt;</td>
<td>0544</td>
<td>0.000* *</td>
<td>Valid</td>
</tr>
<tr>
<td>Y&lt;sub&gt;4&lt;/sub&gt;</td>
<td>0400</td>
<td>0.000* *</td>
<td>Valid</td>
</tr>
<tr>
<td>Y&lt;sub&gt;5&lt;/sub&gt;</td>
<td>0466</td>
<td>0.000* *</td>
<td>Valid</td>
</tr>
<tr>
<td>Y&lt;sub&gt;6&lt;/sub&gt;</td>
<td>0446</td>
<td>0.000* *</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Significant at Alpha 0.01
Characteristics of respondents

The study sampled 486 students with a proportion of male 186 men and 302 women. Respondents most female gender 62%, the remaining 38% male gender respondents. Based on the results of the interview monthly expenditure of students grouped in category < Rp 1 million, Rp 1 million-Rp 2 million, Rp 2 million-Rp 3 million, Rp. 4.000.00-Rp. 5 million, and > Rp 5 million. For 43% of students, spending money on spending between Rp. 1 million-Rp. 2.000.000, this shopping includes food and non-food shopping for a month but excluding the rent of residence. The use of banking services such as debit cards, credit cards, etc for student spending is categorized into 3 categories i.e. never, rarely, and often use them. The size of the three categories is listed in Picture 1, based on the research results of only 4% of students who have not used banking services for shopping transactions. A total of 59% of students stated often using the service. This suggests that the use of non-cash transactions is reasonably mimic by the students for shopping.

In general female sorority often conducts banking services by as much as 60% of students, only 4% of the coed who never do shopping with debit and credit cards. Likewise, male students say often doing shopping with the service is 57%, while 38% stated rarely and 5% never use bank transactions for shopping. The use of electronic money (e-money) as a substitute for money is very demanded by students, but not as much as the use of banking services. 48% of students stated never to use E-money for shopping. A total of 34% of respondents stated often using E-money for shopping, and as much as 18% expressed infrequent use (Pic. 2).

Based on gender, as many as 45% of students stated never to use E-money, while the coed was 50%. The presentation often uses E-money, as many as 36% of female sorority states often use E-money for shopping purposes, while students are 30%. The use of the E-money among new students is still a little compared to the credit/Debit card for shopping purposes, this is in line with the research by Pranoto (2019). It is very natural because people in general and students in this research first know the debit/credit card compared to E-money.

The student spending behavior is listed in table 4. Based on the results of a Survey of 35.25% of students said they often buy products due to spontaneous. It can be interpreted that the coed tends to buy something without careful consideration, not according to the need but rather to the satisfaction gained. But the behavior of the sorority expenditure is still in reasonable terms, it is shown from 33.40% of the coed who started buying items that fit the needs. Male students as much as 18.44% also stated that they often buy spontaneously. Male student spending behavior is also only 3.89% which stated not to buy goods that fit the needs.

Table 4. Student’s Shopping Behavior

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10783
<table>
<thead>
<tr>
<th>Indicators</th>
<th>Never Women</th>
<th>Rarely Women</th>
<th>Often Women</th>
<th>Never Male</th>
<th>Rarely Male</th>
<th>Often Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>I compare prices between stores/supermarkets/supermarkets before making a purchase</td>
<td>6.35%</td>
<td>5.94%</td>
<td>25.82%</td>
<td>19.47%</td>
<td>29.71%</td>
<td>12.70%</td>
</tr>
<tr>
<td>I bought the product due to the discount</td>
<td>13.93%</td>
<td>11.48%</td>
<td>34.02%</td>
<td>19.88%</td>
<td>13.93%</td>
<td>6.76%</td>
</tr>
<tr>
<td>I bought the goods that fit the needs</td>
<td>5.74%</td>
<td>3.89%</td>
<td>22.75%</td>
<td>15.98%</td>
<td>33.40%</td>
<td>18.24%</td>
</tr>
<tr>
<td>I bought the item because it affected ads</td>
<td>41.39%</td>
<td>21.52%</td>
<td>16.80%</td>
<td>13.73%</td>
<td>3.69%</td>
<td>2.87%</td>
</tr>
<tr>
<td>I bought the item because of the desire spontaneously</td>
<td>6.97%</td>
<td>8.81%</td>
<td>19.67%</td>
<td>10.86%</td>
<td>35.25%</td>
<td>18.44%</td>
</tr>
<tr>
<td>I bought items because of my friend's influence</td>
<td>30.53%</td>
<td>18.24%</td>
<td>6.15%</td>
<td>4.92%</td>
<td>25.20%</td>
<td>14.96%</td>
</tr>
</tbody>
</table>

**Shopping score**

The shopping score reflects student spending behavior. The shopping score is calculated from the indicators on the shopping variable. Student spending categories can be categorized under Table 5. The shopping score ranges from 0 to 100. Overall the student shopping score of UI is 66.48, which belongs to the medium category. For this type of color, women have a higher shopping score of 3.43 points than the male shopping score (64.36). It is following Seock and Bailey's Research (2008), which states that women tend to prefer shopping than men. Of 44.47% of UI, students have a high shopping score category. Only 0.41% of students have a low shopping score listed in Table 5.

<table>
<thead>
<tr>
<th>Shopping score Category</th>
<th>Student percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-33.33</td>
<td>Low</td>
</tr>
<tr>
<td>33.34-66.66</td>
<td>Medium</td>
</tr>
<tr>
<td>66.67 -100</td>
<td>High</td>
</tr>
</tbody>
</table>

To measure statistically, the 1 hypothesis test of women's shopping score is higher than that of males, so the T independent one-way test is conducted. The test result is in Table 4, value p = 0.000181 < 0.001 so it can be concluded that women's shopping score is higher against the male spending score with a confidence rate of 99%.

<table>
<thead>
<tr>
<th>Hypothesized Mean Difference</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free degrees</td>
<td>486</td>
<td></td>
</tr>
<tr>
<td>T Stats</td>
<td>-3.59</td>
<td></td>
</tr>
<tr>
<td>P (T ≤ t)</td>
<td>0.00018</td>
<td></td>
</tr>
<tr>
<td>T Critical point</td>
<td>1.65</td>
<td></td>
</tr>
</tbody>
</table>

**Influence of Intensity Banking services against shopping score**

The second hypothesis in this study was the use of banking services impacting student spending. In other words, more and more often use banking services, students will be more likely to have behavior that likes to shop. Picture 8 shows a tendency relationship between
students who have never used banking services having a score of 60.7845 (category: Moderate). Students who rarely use banking services have a 62.4537 shopping score (Category: moderate). The high category is obtained by students who often use the service with a score of 69.4550.

One-way ANOVA test with Test F, it can be noted that statistic Test F 32,294 and the value P = 0.000. It can be concluded that at least one student group (never, rarely, often) has a significantly different shopping score with another student group. In other words, there is a significant difference between the willingness of shopping services to the student spending score with a 99% confidence rate.

Table 7. One-way Anova test

<table>
<thead>
<tr>
<th></th>
<th>Number of squares</th>
<th>Df</th>
<th>Central square</th>
<th>F</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter Group</td>
<td>6,163,788</td>
<td>2</td>
<td>3,081,894</td>
<td>32,294</td>
<td>.000</td>
</tr>
<tr>
<td>In Group</td>
<td>46,284,667</td>
<td>485</td>
<td>95,432</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>52,448,454</td>
<td>487</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To measure the intensity of the use of banking services which give different influence, then conducted an advanced test with multiple comparison Tukey. Table 3 shows the results of the Tukey test. Based on these results, it can be noted that students who are never and students who rarely use banking services do not differ significantly, with the value P = 0.730. It can be interpreted that both groups of students have the same shopping behavior. The different things are shown against the student group's intensity of use of banking services often, they have a different average shopping score that is very significant towards the other student groups (never and varying rarely), with a confidence rate of 99%.

Table 8. Multiple comparison Tukey

<table>
<thead>
<tr>
<th>(I) service. Bank</th>
<th>(J). Bank services</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>Rarely</td>
<td>.730</td>
</tr>
<tr>
<td></td>
<td>Often</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>.730</td>
</tr>
<tr>
<td>Rarely</td>
<td>Often</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Never</td>
<td>.000</td>
</tr>
<tr>
<td>Often</td>
<td>Never</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>Rarely</td>
<td>.000</td>
</tr>
</tbody>
</table>
Influence of Banking services Intensity against shopping score

The use of E-money among students has also become common in UI. This research, wanting to know the relationship between the use of E-money for shopping with student spending scores. Some patterns tend to rise in student groups who have never used e-money and students who often use e-money towards their spending scores. Students who often use E-money have a much higher score, 8 points than students who rarely make e-money. This suggests that current shopping phenomena have been able to use E-money as a substitute for cash among UI students. Students who have never used E-money have a 63,231, shopping score (moderate). The same thing on students rarely to match E-money has a score of 65.21 (moderate). The student groups who often use E-money have a score of 71.82 (high).

![Graph showing student spending score based on E-money usage intensity](image)

In a one-way ANOVA test with an F test, it can be noted that the test statistics F 39,125 and the value P = 0.000. It is, it can be concluded that a minimum of one student group (never, rarely, often) who uses E-money has a significantly different shopping score with another student group. In other words, a significant difference between the E-money is the intensity of the management of the student spending score with a 99% confidence rate.

<table>
<thead>
<tr>
<th>Number of squares</th>
<th>df</th>
<th>Central square</th>
<th>F</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intergroup</td>
<td>7,286,380</td>
<td>2</td>
<td>3,643,190</td>
<td>39,125</td>
</tr>
<tr>
<td>In the group</td>
<td>45,162,074</td>
<td>485</td>
<td>93,118</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>52,448,454</td>
<td>487</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Advanced Test *Multiple comparison Tukey* to find out which group gave the average score different from the other group. Based on these results, it can be known that students who have never and students who rarely use e-money do not differ significantly, with the value P = 0.225 in Table 10. It can be interpreted that both groups of students have the same shopping behavior. The different things are shown against the student's group with the intensity of often using e-money, they have a different average shopping score that is very significant towards another student group (never and intensity is rare), with a confidence rate of 99%. In other words, based on the intensity of e-money towards shopping scores can be divided into 2 groups i.e. the first group consisting of students who never and rarely use E-money, the second group is a student who often uses e-money for shopping.

<table>
<thead>
<tr>
<th>(I) Emoney</th>
<th>(J) Money</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>Rarely</td>
<td>.225</td>
</tr>
<tr>
<td>Often</td>
<td></td>
<td>.000</td>
</tr>
</tbody>
</table>
Rarely | Never | .225  
---|---|---
Often | Never | .000  
Often | Rarely | .000

IV. Conclusions and Implications

UI student's shopping behavior is still in the medium category. The behavior between women and men in shopping is very different. Women have higher spending scores than men. The use of cash to non-cash transactions is also favored by a group of student UI. Student behavior that often uses non-cash Transaction also has a high shopping score. The shopping behavior has a significant relationship with the intensity of non-cash transaction usage. Students who often use the noncash transaction using either debit, credit or e-money have a much higher shopping score than students who never or rarely use them.

REFERENCES


Factors Hindering Sustainability of Water Projects in Makueni County: A Case Study of Kwing’ithya Kiw’u Project

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ABSTRACT: This study sought to establish factors hindering sustainability of water projects in Makueni County so as to make appropriate recommendations for enhancing sustainability of water projects. The descriptive survey design was employed in this study. The study population constituted the inhabitants of the two wards, key informants especially the self-help group which partnered with the NGO, Local sub-chiefs of the 7 sub-locations within the two wards. The household survey was used to reach the respondents and purposive identification of the subject matter or key informants across relevant local institutions was conducted. Both probability and non-probability sampling techniques were used in the study. Questionnaires were administered in this study to help in quantitative data collection from the respondents. Finally, the data was analyzed using descriptive statistical tools (SPSS V.17.0 and Excel) which helped the researcher to describe the data. The study established that the level of stakeholders’ participation in the water projects was low which affected the sustainability of water project. Also, stakeholders’ participation positively enhanced the sustainability of the rural community based water projects to a great extent. The water project has enhanced partnerships between the local community and the government or non-governmental organizations. There was insufficient technical expertise to manage the project, and human resource for sustainability of the project. The level of adoption of technology in the management of water project was very low impairing the sustainability of water projects. The study recommends that the level of stakeholders’ participation in the project planning and implementation should be increased to enhance the sustainability of the water projects in the county. Also, the project management should seek to adopt modern technology through increased budgetary allocations. Government should institute stringent measures to deal with persons vandalizing the community water project.

Index Words: Community based projects, Sustainability, Stakeholders’ participation, Cultural practices

1. INTRODUCTION

In the developing world there are more than 1 billion people who are unable to access, on a daily basis, a reliable source of clean and fresh water. This led to declaration of the Millennium Development Goals (MDG), which has, the specific target, of reducing by half the proportion of people without sustainable access to safe drinking water by 2015 (United Nations 2000). There have been improvements made towards meeting the water supply needs for the world’s poor, in the year 2002, 79% of the population in developing countries had access to clean and safe water supplies, bringing up the total world coverage to 83%. This is an increase of 8% from 1990 to 2002 (WHO/UNICEF 2008).

According to De Regt (2005), over 75% of the Africa’s poor living in rural areas the need to expand sustainable water service to these areas is imperative. Most of community based water projects fail due to a lack of understanding of the specific context of the community or a lack of effective support structures (Reif et al. 1996; Baker 2000). In Kenya access to clean safe water supply in rural areas remains low. In particular, over the past eight years access to piped water has only increased from 9 to 10 percent of rural households. Small community-based water providers are seen as part of the solution and are supported by the Water Sector Act of 2002, which introduced regulatory and tariff reforms. The recognition by the UN General Assembly, in 2010, of water and sanitation as a human right provides additional political impetus towards the ultimate goal of providing everyone with access to these vital services. With this in mind, the United Nations Millennium Development Goals (MDG) aimed at halving the proportion of people without sustainable access to safe drinking water and basic sanitation by the year 2015 (WHO, 2010).
According to Gebrehiwot (2006), in developing countries different institutions which includes; national and regional governments, local and international NGOs and other concerned organizations invest large sums every year for the implementation of rural water supply projects. It is evident that construction of water projects does not help if they are done in ineffective way and fail after a short time. The World Bank's private arm, the International Finance Corporation, found that only half of its Africa projects succeed (Associated Press, 2007). Through better integration of people who receive the water and water project suppliers in making decisions concerning planning, construction and management of water supply systems makes investment in water supplies more effective and failure rates of these systems reduced (Gebrehiwot 2006). However, in Kenya, community based water project are characterized with low or poor stakeholders involvement.

Communities have failed to take up ownership of projects which according to Williams (2003) has plunged community projects into immense financial huddles threatening the sustainability and hence threatening them to seize operations daily. In fact, most studies shows that low levels of education concerning sanitation and water supply, poor management system, limited demand and perceived lack of ownership are related to poor implementation and low sustainability rates of water supply systems (Harvey & Reed, 2007). In order for proper implementation and future sustainability there is need for genuine involvement of the targeted community whose concerns and experience are intrinsic to the project's success (Admassu et al., 2002). The willingness and the level of community support determine whether a project becomes implemented, how quickly and successfully it consolidates, and how it responds and adapts to meet changing needs (USAID, 2009). Therefore there is need to involve community in the whole project cycle from planning to closure, involving them in decisions making enhances the chances of successful sustainability of water projects. In Kenyan scenario is quite different, only the elite from community are actively involved in planning, implementation and running of such water projects.

Good management contributes a lot to the success of project implementation and it’s sustainability, especially when there is trust and good working relationship amongst project team, local people and professionals. In order to establish good rapport leaders need time, resources and authority to invest in a project. It is of important to note that, the project manager and the entire project team should understand their roles in the project cycles since good leadership is critical for the success of community based projects. Leadership offer management to the project and thus ensures sustainability. However, due to financial management constraints most community water projects stall. This threatens survival of the said projects. Mismanagement of community based water projects; acts as a stabiling block to natural development of the project. It leads to over dependence on funding boxing community based projects into a dependency syndrome which is threatening the sustainability.

As said earlier, research has shown that rural water supplies in sub-Saharan Africa, often demonstrate low levels of sustainability (Gebrehiwot, 2006). Rural areas in sub-Saharan Africa are characterized by poor water access points, where water collection may require hours of physical effort, water sources are contaminated. Alternatively local community must purchase at rates too expensive for proper health and hygiene. In addition in rural areas water resources are managed community what is commonly referred as community management. Community based management is one of the oldest form of social organization. However, after colonial rule and westernization number of issues came up, such as dynamic political change, rapid population growth, environmental degradation, climate change, misguided development policies, and the shift from agrarian economies to market economies, community management systems are in jeopardy of losing their resilience and effectiveness (USAID, 2009).

Four major critical areas that contribute to community water project sustainability, which includes; the physical and operating environment, availability of finance, the socio-political stability of the country and community, and a community’s ability to access some funding, be it private, public, or non-governmental (Niyi et al., 2007). Kenya is characterized by inadequate technologies which have threatened implementation and survival of many community water projects like in other sub-Saharan Africa countries. There is insufficient of sophisticated machines like modern water powered pumps, poorly implemented water supply networks for ensuring access of water by all community members. With this problem, community members have to walk long distances searching for water from other sources hence undermining the reason for such community water projects and thus threaten sustainability of community based water projects.

Despite, the immense importance of community based water project in ensuring access to clean drinking water for all, no study has been conducted locally or internationally to establish factors hindering sustainability of water projects in Makueni County. This study therefore sought to establish various factors hindering sustainability of water projects; which was achieved through investigations on how stakeholders’ participation, cultural practices, management skills and technology hindered sustainability of water projects in Makueni County.

This study was guided by the following research objectives: to establish how the extent of stakeholders’ participation hinders sustainability of water projects, to assess how cultural practices hinders sustainability of water projects, to examine how management skills hinders sustainability of water projects and to examine how technology hinders sustainability of water projects.
2. LITERATURE REVIEW

According to Aras and Crowther (2008), there are four aspects of sustainability namely; societal influence, environmental impact, organizational culture and finances. When analyzed critically, societal influence measures the impact a society makes upon the corporation in terms of the social contract and stakeholder influence; environmental impact, which is the effect of the actions of the corporation upon its geophysics environment; organizational culture, which is the relationship between the corporation and its internal stakeholders and finances an adequate return for the level of risk undertaken in pursuit of sustainable development and financial sustainability.

According to Brager et al. (2001) defines participation as a means of increasing competence amongst community members through educating them. Community participation is the tool for influencing decisions that have direct impact to the lives of citizens and forms grounds for ensuring project sustainability of successful. Citizen participation is a process by which citizens act in response to public concerns, voice their opinions about decisions that affect them, and take responsibility for changes to their community, their support, he pointed out is key for the sustainability of a community project (Armitagem, 2003). Chappel (2005) suggest that stakeholders support may also be a response to the traditional sense of powerlessness felt by the general public when it comes to influencing government decisions: by their support, community ensures the success of a project through collective efforts to increase and exercise control over resources and institutions on the part of groups and movements of those hitherto excluded from control”. Further, Group on Participatory Development (2001) indicated that this support ensures that stakeholders influence and share control over development initiatives, and the decisions and resources which affect them. This is vital in ensuring that resources in community based projects in Kenya are managed effective, minimizing wastes and thereby ensuring their sustainability more so financial sustainability.

According to Oakley and Marsden (2007) stakeholders’ support brings together individuals, families, or communities who assume responsibility for their own welfare and develop a capacity to contribute to their own and the community’s development. Community participation can be viewed as an active process whereby beneficiaries actively take part and be part of determining the direction and execution of development projects rather than waiting the project to be completed to enjoy its deliverables. Through community participation resources are saved which can later be channeled to produce more benefits out the project. Chappel (2005), argues that if community actively participate in the project then project costs are shared that is money and labour during the project’s implementation or operational stages which ensures financial sustainability.

Community participation forms the major stakeholder support in any community based project (Oakley and Marsden 2007). In fact, involvement of the communities is crucial for the sustainability of rural water supply systems (Admassu et al., 2002). Nevertheless, factors that contributes to high rates of sustainability of community based projects include; communities’ accepting ownership and managing these water projects, existence of management at grassroots i.e at the village level, protection of the water points, cost recovery for operation and maintenance through community small contributions, sound technology put in place and availability of the spare parts of equipment and machineries used.

Chappel (2005) indicated that community support increases project efficiency: Therefore, he recommended that there should be proper consultation with the community during project cycle implementation that is from planning to closure. In addition beneficiary involvement is paramount since it ensures proper implementation of the project enhancing its sustainability. Further, Arbitrage (2003) highlighted that community support increases project effectiveness helping in realization of project’s objectives and ensuring that benefits go to the intended people. It is worthy note that community support coupled with community participation, helps in building beneficiary capacity; by ensuring that participants takes part in project planning and implementation or through formal or informal training and consciousness- raising activities.

Partnering with the communities ensures that people’s problem solving capacities improves and chances for high levels for sustainability are increased.

Bhandari and Grant, 2007; Mbata, 2006, indicated that stakeholders willingness to participate through paying in cash, materials, labor, and idea can be taken as a useful indicator for the demand to sustain water projects. If willingness to pay for services as a result of completed project increases in the community, then it is possible to conclude that the awareness of the community ownership of the project has increased (Mbata, 2006). Similarly, if households are willing to contribute cash and labor useful for the management of water sources, then the service that they obtain from a source is valued; and, it is a means of promoting its sustainability.

Culture is broadly defined as the whole complex of spiritual, material, distinctive, intellectual and emotional features that characterize a society or social group of people. It includes arts, letters and mode of life, value systems, fundamental rights of human being, beliefs and traditions (UNESCO, 1995).Culture is gradually emerging out of the realm of social sustainability and being recognized as having a distinct, separate, and integral role in sustainable development. Within the sustainability sector, according to
Culture is discussed in terms of cultural capital, defined as “traditions and values, heritage and place, the arts, diversity and social history”. The stock of cultural capital, can either be tangible and intangible, this is what we inherit from past generations and what we will pass onto future generations. UNESCO (2006) encompass cultural development as related to social policy and goals such as fostering rural revitalization, public housing, health, ecological preservation, cultural diversity, rural diversity, social inclusion, and sustainable development. Culture is adversely affected by globalization and market forces therefore it must protected under all costs, as many communities fear that they will lose their cultural identity, traditions, and languages to dominant ideals and culture. To address above concerns, sustainability discussions should focus on education, community development, and locally based policy that is consistent with community culture that is open to change. In addition according to (Matthews and Herbert, 2004)sustainability discussions on cultural heritage should focus on the need to preserve what was inherited so as to pass to future generations, and to recognize the history of a place and the tangible and intangible attributes of its landscapes and communities. The creation of opportunities to expand and deepen diversity may act as a balance to this.

Cultural development in a community is a collective process, involving creativity interpreted in the broadest sense (Mills & Brown, 2004). The impact of this is to changes in people’s lives and long-term developmental benefits for a community. Cultural development in a community captures a large cross sectional area of activities that give communities the opportunity to tell their stories, build their creative skills, and be active participants in the development of their culture (O’Hara, 2002).

Doubleday et al. (2004) observe that Discussion of sustainability, as now incorporated both dynamic understandings of culture and the recognition that place matters, because the practice that is in need of sustaining, as well as those that pose threats, happen in particular communities and in specific geographic contexts. Serious discussions of sustainability require considerations of the dynamics of complex cultural arrangements in particular places, rather than assumptions of either peoples or their ecological contexts” and that fundamental debates on sustainability must contrast environmental and cultural preservation with active practices of living in culturally constituted places.

As Ledwith (2005) observes, community development begins at the everyday lives of local people. Community development projects empower communities to position local issues within a larger political context. An important aspect of community development is that it is not handed down from experts or governments. Community development aims to strengthen the economy and the social ties within a community through locally based initiatives. The community development process is often characterized as a bottom line of amalgamating environmental, social, and economic well-being into a common audit. The bottom line is now expanding to include cultural well-being and good governance. The central goals of community development rely on residents having the ability to express their values, be self-reliant, satisfy basic human needs, and have greater participation and accountability in their community. This is accomplished by education, citizen participation, consensus building, and access to information. Creating a sense of place in the community is central as it empowers residents to become decision-makers over their own environment, resources, and future.

Sustainability is reflected in the capacity of the community to cope with change and adapt to new situations since change is inevitable (Williams, 2003). Community sustainability is about creating a more just and equitable community through encouraging social and cultural diversity (Roseland et al., 2005). It also calls for the community to define sustainability from its own values, culture and perspective. This cut across community participation and a collective decision-making process that meets the social, cultural, environmental, and economic needs of the community. Sustainable community development takes in consideration development of a local and self-reliant economy that does not damage the social well-being of communities. They seek methods of integrating policies, programs, and design solutions to bring about multiple objectives (Beatley & Manning, 1997). Sustainable project design utilizes essential aspects of cultural identity, can serve to synthesize the past with the present for the benefit of the future.

Management in organizations including non-profit organizations and government bodies, refers to the individuals who set the strategy of the organization and coordinate the efforts of employees or volunteers to accomplish objectives by using available human, financial and other resources efficiently and effectively. Resourcing encompasses the deployment and manipulation of human resources, financial, technological and natural resources. On other hand management of projects involves increasing the alignment of development projects with the direct beneficiaries’ priorities and coordinating aid efforts at all levels (local, national, and international) to increase ownership and efficient delivery of services. Basically it involves offering leadership to achieve certain laid objectives. Good management ensures that sufficient local resources and capacity exist internally to continue the project in the absence of external resources (McDade, 2004).

Due to complexity of community based projects multifaceted management skills are required. Therefore a project manager (PM) has to manifest both project management related skills (Kirsch, 2000) and technical expertise as required by the project (Thite, 2001). Project management activities include; defining project scope, managing resources, and advising about technical architecture, estimating project schedule and budget, identifying specific and general project management practices and escalation procedures, ascertaining and managing risks within a project and preparing risk mitigation measures.
The matching or fit between a PM and project extends not only to the technical skills as enumerated above, but also to other general project-PM profile attributes, such as prior exposure to the methodology experience (Swanson & Beath, 2000). A PM is senior most people within a project undertaking and is perceived to possess a sounding bank for technical and architectural decisions made for the project. In addition, according to (Bloom, 2006) observed that PM is also expected to demonstrate a deep knowledge and understanding of the business objectives of the project being undertaken. Prior literature has shown that past experience of the similar project helps in improving performance and increasing sustainability of a project (Goodman & Leyden, 2001). Having undertaken similar projects elsewhere PM possess deep understanding of project characteristics such as technology, or methodology which improve sustainability (Banker and Slaughter 2000).

According to Espinosa, et al. (2007) task familiarity is important in the community based projects and this is usually linked to performance which in turn is linked to sustainability. As irsch (2000) and Thite (2001) argues that, a PM should take the leadership role not only in managing the project but also leading the technological initiatives.

Fiedler et al. (2004) define leadership as a process by which one individual insight others toward the attainment of group or organizational goals/objectives. They emphasize three points about the definition of leadership i.e leadership is a social influence process, elicits voluntary action on the part of followers and results in followers’ behavior. For leadership to exist, two parties must be involved a leader and one or more followers. Secondly, the voluntary nature of compliance separates leadership from other types of influence based on formal authority which results in followers’ behavior that is purposeful and goal-directed in some sort of organized setting.

McDade (2004) states that leaders who possess good management skill are considered to be good leaders and therefore, they steer their organizations to prosperity. A definite nature of leadership and its relationship to key criterion variables such as satisfaction of subordinate, their commitment, and performance is still uncertain, leadership does remain unexplainable concept.” However, not all leaders can make to be good managers. Therefore, in the quest to establish effect of management skills on implementation and sustainability of community projects, we must distinguish leadership from management. Basically management involves planning, organizing, staffing, directing, and controlling, and a manager is someone who performs these functions (Chemers & Mahar, 2004). A manager has formal authority by virtue of his or her position or office while leadership, by contrast, primarily deals with influence a person possess towards others. A manager may or may not be an effective leader. Andriessen and Dreath (2007) observe that a leader's ability to influence others to do something and achieve set objectives may be based on a variety of factors other than his or her formal authority or position.

Project managers must possess influence capacity to others so as to increase the probability of successful project implementation and its sustainability. However, they need not only to possess good management skill but leadership skills as well. On daily basis PMs interacts with many stakeholders, they must build a good relationship with internal project teams, their peers and superiors, clients, using skills that are non-technical in nature and which aren’t be easily imitable for the project to succeed. According to (Kirsch, 2000) these skills include; tacit knowledge, leadership and management skills, organizational knowledge, and customer handling skills. Within project management teams, as project team progress from technical to more managerial jobs within the project, these skills come into play, and help in effective and efficient project management. Wagner and Sternberg (1985) argue that tacit skills are more effective that are gained through experience rather than being acquired in a classroom. Tacit skills are classified as skills related to managing self, career and others. They find that differences in these skills between a novice and an expert are consequential for career performance in professional and managerial career pursuits. Both hard and soft management skills are required for successful project management especially in implementation and sustainability (Kirsch, 2000). Hard skills are tangible which comprise project management experience, technological skills, domain expertise, and project management skills such as planning, risk management, monitoring and scheduling. Soft skills are intangible, and are normally concerned with working and managing people and fostering inter- and intra- organizational “relationships.” These skills include; tacit knowledge, leadership and management skills, organizational knowledge, and customer handling skills. Both technical and transformational leadership skills are required of IT managers for effective leadership (Thite, 1999) also Byrd and Turner (2001, shared the same sentiments. However, no study that measures direct correlation between direct impacts of the PM’s skills especially soft skills, on project success have been done yet.

A project manager can use general human capital to increase productivity in many firms or project. These general human capitals includes technological skills, risk management, coordination, domain expertise, project management experience, and project management skills such as planning and monitoring. Some of human capital utilizes skills that are soft, which are specific to a particular firm or environment (Becker, 1975; Lee et al., 1995; Kirsch, 2000). Project team members play a crucial role in determining project performance as well as the PM’s hard skills. When team members familiarize themselves with each other, it calls for lower coordination effort, because familiarity can provide information about the task and task stakeholders (Espinosa et al., 2007). For example, if team members interact with each other during project implementation and sustainability, a road map of expertise is developed, that is, they know where and how to locate the expertise needed when in the next project activity (Boh et al., 2007).
Because coordination is easier to accomplish in a more familiar team, we expect that the PM’s soft skills to be more helpful for less familiar teams, in terms of facilitating project performance and therefore ensuring sustainability of the community based water projects.

Previous literature has investigated the relationship between personnel’s management skills and project success (Pagell et al., 2000). The approach assumes that there is a direct relationship between the performance, organization, and context, and thus predicts a unidirectional effect between skills and performance of any project. While the direct impact of these skills is anticipated, it is important to explore the correlation between PM skills and the project characteristics and its impacts to project sustainability. Page II et al., (2000) find that the impact of fit between skills and environment on performance is more significant compared to the direct impact of skills on performance.

Matching of resources with the project needs is paramount therefore Project managers should perform that role. Resource allocation requires a matching of project characteristics with the skill sets possessed by the Project Manager. Such a matching can be viewed as a strategic choice in response to the (project) environment. Venkatraman and Prescott (1990) and Martin et al (2004), suggest that any deviation from an optimum resource allocation patterns should be significantly and negatively related to performance of any community based project and thus sustainability will be impossible.

Sampat, 2006 observes that project managers have always appreciated the role technology in the production process, project performance, and human welfare, that is, when inappropriate technology is put in place then sustainability of water projects becomes a challenge. Poor management and accountability forces unprecedented equal distribution of resources which arises due to repeated economic crises and steadily increasing failure in water projects (Hagedoorn & Cloodt, 2003). Sustainability has been a challenge to all water projects. At the same time, technology is developing with supersonic speed and is becoming the principal instrument for addressing these challenges. This is the reason why many community water based projects are allocating large amounts of money in implementing modern technology like information systems. However, the advantages offered by technologies, especially in increasing productivity, depend upon how well these technologies are a lined into the projects objectives.

Recently, Information Technology (IT) has undergone transformation from implementation of IT applications to an age of IT-enabled change that is technology working for us. The fundamental question is how we can manage our IT projects better in order to maximize their economic benefits and value. The importance of technology on sustainability of water projects shows that, sustainability of rural water supply system is influenced by both factors controlled by the project and those which are not controlled by the project; factors controlled by the project may include; training, technology, cost of the project and construction quality. However, on the other hand, factors that are not controlled by the project include communities’ poverty level, access to technical assistances and spare parts (Mbithi & Rasmuson, 1999).

Use of modern technology is key in sustainability of water projects because makes operations and maintenance easy. One of the most crucial elements for sustainability of community based water projects is the effective operation and maintenance (O & M) of rural water supply systems. According to Binder (2008) in case financial resources are inadequate and frequent supports unavailable then, the community management of rural water supply systems on operation and maintenance (O & M) is not successful. Budgeting sufficient funding for rural water supply systems is an importance for successful sustainability.

Enormous influence on water project is felt due to technological innovation (Nohria & Gulati, 2006). For instance, technological innovation plays an important role in influencing the improvement of performance and therefore ensuring successful project sustainability. With more rapid technical transformation, it is evident that the ability of organizations to innovate new products and services is a crucial influence on sustainability (Hitt & Rothermell, 2003). As depicted in many studies, there exist a very strong positive correlation between a project’s technological innovation and project sustainability, and concluded that technological innovation is important factor for implementation, performance and sustainability (Foster, 1986).

Some of desirable characteristics of water projects sustainability includes; value, rarity and inimitability. The economic value of many firms and community project is increasingly derived from intangible assets (Dunning & Lundan, 2010; Kramer et al., 2011), what this means is that more emphasis should focus on dynamic resources, which include knowledge and inimitable and distinct technologies (Prahlad & Hamel, 1990). These innovations drive performance.

According to Hagedoorn and Cloodt (2003) defines innovation in two broad sense; they argues that innovation performance refers to knowledge of technological, inventive and innovative operations. On the hand, innovation performance can also be expressed in product performance and process performance (Cockburn et al., 2010). Hopkins and Brynjolfsson (2010) observe that a performance gap exists between companies that embrace technology and those that resist it; therefore, innovation directly correlated to technologies. Similarly, community water projects that integrate technology with the lied objectives exhibits better implementation, performance and sustainability than those that doesn’t. Sustainability of community based water projects driven by technology.
depends largely on; the effective management of the innovation process, and managers should continue to identify, develop, protect, and allocate resources and capabilities in order to gain a sustainable competitive advantage (Amit & Schoemaker, 1993). The advances in IT have significantly of importance which has adversely changed the way computerized information systems can be used in water projects. Its role in service-sector firms and its impact on the effectiveness of the firm’s operations and sustainability have been identified (Rubenstein & Greisler, 2000).

In addition, stakeholders require frequent updates of the progress of the project so as to ease assessment of those projects. Therefore the water projects have no option rather than to invest in information systems. Information technology supports a number of functions in community based project; which includes; significant change on the way projects interact with stakeholders. Secondly; provision of information extracted from their records to improve members’ satisfaction (Li, 1997); this ensures personalized service delivery to members. With the help of IT Stakeholders can track the effects of automated admissions into the project for those who were not there on onset of the project, reporting project faults, and the improved efficiency and accuracy of billing and office systems.

3. RESEARCH METHODOLOGY

Descriptive survey was employed in this study. According to Schindler (2003) descriptive survey it attempts to describe or define a subject, often by creating a profile of a group of problems, people, or events, through the collection of data and tabulation of the frequencies on research variables or their interaction as indicated by Cooper and Thus, this approach was appropriate for this study as it helped in collection without changing the environment. Sometimes is referred as “correlational” or “observational” studies. The study employed descriptive design in this study since it sought to establish the factors that hinder sustainability of water projects in Makueni County, a case of Kwing’ithya Kiw’u water project.

Kwing’ithya Kiw’u water project was taken as the study project which was funded by ACTION AID which cuts across two wards that is Kikumbulyu North and South. Both qualitative and quantitative data was used to explain the sustainability issues was explained used focusing a wide cross section of characteristics including those of households, and socio-economic activities, technological and structural issues affecting projects’ sustainability. Data gathered and analyzed was used to make generalization with regard to the sustainability factors for water projects.

The study population constituted the inhabitants of the two wards, key informants especially Kwing’ithya Kiw’u Self Help group which partnered with Action Aid (NGO), Local sub-chiefs of the 7 sub-locations within the two wards. This included cross section of people involving those who have been involved in the development of the projects, use, management, as well as those with expert information or data about these community based projects. The respondents were reached through household survey and purposive identification of the subject matter or key informants across relevant local institutions. In terms of the exact population size, according to population (2009 national census) the wards have the following populations; Kikumbulyu North ward (Kathyaka, Ngulu, Ndetani sub-locations) had a population of (20,314) and Kikumbulyu South ward (Mbui Nzau, Kalungu, Ngandani and Mikuyuni sub-locations) had a population of (26,368). Further, the study focused on the former 23 employees in the Kwing’ithya kiw’u water project.

The study area was Makueni County specifically Kikumbulyu South and North. According to the 2009 census, both Kikumbulyu South and North has seven villages which includes Kathyaka, Ngulu, Ndetani Mbui Nzau, Kalungu, Ngandani and Mikuyuni sub-locations and they constituted to a total population of 46,682 (Census data, 2009). This study was intended to collect data from communities residing in the seven sub locations and specifically people around the water projects. Both probability and non-probability sampling methods were combined to achieve maximum reliable responses for triangulation of themes.

A sample was drawn from the households which helped in providing reliable information regarding the objectives of the study. Three factors are considered to determine the size of an adequate sample which includes the nature of the population, the type of investigation, and the degree of precision desired (Van Dalen 1979). Krejcie and Morgan (1970) provide the formula was used to estimate the sample size and a table for determining the sample size based on confidence level needed from a given population.

\[
S = \frac{X^2 \ NP (1 - P)}{d^2 (N - 1) + X^2 \ P (1 - P)}
\]

Where

\[S = \text{required sample size}\]
N = the given population size

P = population proportion that for table construction has been assumed to be 0.50, as this magnitude yields the maximum possible sample size required

d = the degree of accuracy as reflected by the amount of error that can be tolerated in the fluctuation of a sample proportion p about the population proportion P - the value for d being 0.05 in the calculations for entries in the table, a quantity equal to

\[ \pm 1.96 \sqrt{\frac{P(1-P)}{N}} = \pm 1.96 \sigma_p \]

\[ X^2 = \text{table value of chi square for one degree of freedom relative to the desired level of confidence, which shall be 3.841 for the 0.95 confidence level represented by entries in the table according to the 2009 census, the population of the seven sub-locations was 46,682. Applying this to the above formula the minimum sample size be 381. According to the Evaluation report of 2012, the average household size is 4.27. This was divided by the sample, giving a minimum of the 89.23 (90 households to be interviewed).} \]

The study used a combination of both probability and non-probability sampling techniques. The probability sampling techniques included simple random sampling, cluster sampling procedure, and systematic sampling procedure. For quantitative data collection, Cluster sampling procedure was applied where the settlements are not evenly distributed but settled in clustered households near the water projects. Simple random sampling was applied first within the clusters to randomly pick the first household for administration of questionnaires. Once the first household is randomly identified, Systematic sampling procedure was employed to collect data through questionnaires in the subsequent households within the cluster. The systematic procedure was often applied where the settlements existed in a linear order.

In the case of non-probability sampling technique purposive sampling was applied. This procedure was applied to collect qualitative data especially in identifying and reaching the key informants on particular themes. Purposive sampling procedure involved selection of a sample on the basis of the researcher’s own judgment depending on the elements and the nature of the research objective. This was applied in identifying and conducting informant interviews for various leaders and also participants for group discussions. It is often applied when the informants have a specific type of knowledge or skill required in the study.

A number of methods were applied to collect both primary and secondary data in order to generate quantitative and qualitative data. A questionnaire from the respondents (beneficiaries of community water projects) was applied in this study to collect quantitative data. Also, the study sought responses from staffs working in the projects. An introductory letter from the University was obtained by the researcher to collect data from the water project, with the help of research assistants he delivered the questionnaires to the respondents and had them filled in. A keen review of Ministry of water Publications, water project reports, journals, development plans, survey maps, and newspapers formed secondary data. The above mentioned documents contained relevant literature to the area and topic of the study.

Data was collected by use of self-administered questionnaire for the respondents. The researcher obtained approval from the University to permit data collection. The researcher explained the purpose of the study and offered guidance to the respondents on the way the questionnaire should be filled. For those respondents who don’t have capacity to read and write the researcher interviewed them and filled in the questionnaire for them. Drop and pick later method was employed during data collection where the respondents were left with the questionnaire to fill in their appropriate time. In order to increase the response rate the researcher made subsequent visits to remind the respondents to fill the questionnaire.

A pilot study was conducted to test and refine the research instrument so as to determine whether the results collected from the ground gave the true representation. To establish the validity of the research instrument the researcher sought the opinions of experts in the field of study especially the researcher’s supervisor and lecturers. Reliability of the research instrument was enhanced through a pilot study that was conducted at Makueni County Ministry of water by selecting 30 respondents. According to Cooper and Schindler (2003) statistical conditions were not necessary in the pilot study. The pilot data was not included in the actual study. The pilot study allowed for pre-testing of the research instrument. This reliability estimate was measured using Cronbach’s Alpha coefficient (\( \alpha \)). According to Nunnally (1978) recommends that instruments used in research should have reliability of about \( \alpha \geq 0.70 \) and above.

Clear guidelines were followed to analyze data, the first step the researcher edited completed questionnaires completeness and consistency, data clean-up followed; which included editing, coding, and tabulation in order to detect any inconsistencies in the responses and specific numerical values were assigned to the responses for further studies. The data was analyzed using descriptive statistical tools (SPSS V.17.0 and Excel) which helped the researcher to describe the data. The Likert scale was used to analyze the mean score and standard deviation. To study the relationship amongst cultural practices, technology, management skills and stakeholders’ participation and financial sustainability, the researcher employed a multivariate regression model. The research used
regression method for its ability to test the nature of influence of independent variables on a dependent variable. Regression is able to estimate the coefficients of the linear equation, involving one or more independent variables, which best predicted the value of the dependent variable. This is what a correlation analysis cannot provide as compared to a regression analysis. Further, correlation analysis was meant to illustrate the direction of relationship between two variables but not how much the independent variable influences the dependent variable. Therefore, the researcher used the linear regression analysis to analyze the data. The regression model will be as follows:

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon \]

Where: \( Y \) = Community Based Project Implementation and sustainability; \( \beta_0 \) = Constant Term; \( \beta_1, \beta_2, \text{ and } \beta_3 \) = Beta coefficients; \( X_1 \)= stakeholders’ participation; \( X_2 \)= Cultural practices; \( X_3 \)= management skills; \( X_4 \)= Technology and \( \varepsilon \) = Error term

The findings were presented using tables and graphs for further analysis and to facilitate comparison. This generated quantitative reports through tabulations, percentages, and measure of central tendency.

4. DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Response Rate

As depicted in Table 4.2, the study targeted a population of 90 household respondents and 23 water project employees. The respondents returned their questionnaires as shown by table 4.2. According to Mugenda and Mugenda (1999), this response rates were sufficient and representative. It conforms to stipulation that a response rate of 50% is adequate for analysis and reporting; a rate of 60% is good and a response rate of 70% and over is excellent. Extra efforts were made to achieve this commendable response rate.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Targeted</th>
<th>Returned</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household respondents</td>
<td>90</td>
<td>90</td>
<td>100%</td>
</tr>
<tr>
<td>Water project employees</td>
<td>23</td>
<td>20</td>
<td>86.9%</td>
</tr>
</tbody>
</table>

4.2 Pilot Test Results

Reliability according to Mugenda and Mugenda (2003) is a measure of the degree to which research instruments yield consistent results of data after repeated trials. To improve on reliability in this study, piloting of the questionnaires was done among 30 selected households. These members were then not allowed to participate in the actual study to avoid contamination of the study sample. The pilot questionnaires were analyzed for reliability using the Cronbach’s reliability test. The judgment on reliability of tools was based on Fraenkel & Wallen (2000) guidelines which state that an alpha value of 0.7 infers that the tools are adequate and can be adopted for the study without amendments. Questions in each study variable gave a Cronbach alpha value that is greater 0.7; hence, they were all adopted for the study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N of Items</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders’ participation</td>
<td>7</td>
<td>0.727</td>
</tr>
<tr>
<td>Cultural practices</td>
<td>7</td>
<td>0.806</td>
</tr>
<tr>
<td>Management skills</td>
<td>7</td>
<td>0.834</td>
</tr>
</tbody>
</table>
4.3 Socio-Demographic Characteristics of Respondents

The study sought to establish information on following aspects of respondents’ background such as time of being a resident, gender, professional qualification, occupation, and average income. The aim of the information was to test the appropriateness of the respondent in responding to the questions regarding factors hindering sustainability of water projects in Makueni County, Kenya.

4.4.1 Being a Resident

The study sought to establish out the whether the household respondents were resident of the area under study.

Table 4.3 Being a Resident

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

From the Table 4.2, 100% of the household respondents were residents of Kikumbulyu South and North and therefore they would give reliable information about water project in Makueni County.

4.3.2 Years of Being a Resident

The study sought to establish for how long the respondents had lived in Makueni County.

Table 4.4 Years of Being a Resident

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years and below</td>
<td>5</td>
<td>5.5</td>
</tr>
<tr>
<td>11-20 years</td>
<td>12</td>
<td>13.3</td>
</tr>
<tr>
<td>21-30 years</td>
<td>48</td>
<td>53.3</td>
</tr>
<tr>
<td>31 years and above</td>
<td>25</td>
<td>27.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
From the findings in Table 4.4, most of the household respondents (53.3%) had lived in Makueni County for 21-30 years, 27.9% for 31 years and above while 13.3% had lived for 11-20 years; finally 5.5% had lived for 10 years and below. This shows that the household respondents had stayed in Makueni County for long enough to give reliable information about the sustainability of water projects in Makueni County.

4.3.3 Gender Distribution of Respondent

The study sought to establish out the gender of the respondents.

Table 4.5 Gender Distribution of Respondent

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>48</td>
<td>53.3</td>
</tr>
<tr>
<td>Female</td>
<td>42</td>
<td>46.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

From the results in table 4.5, majority (53.3%) of the household respondents were male while minorities (46.7%) were female. The findings indicate that majority of the households were headed by males.

4.3.4 Highest Level of School/Level

The study sought to investigate the highest academic qualifications of the respondents.

Table 4.6 Highest Level of School/Level

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Primary</td>
<td>20</td>
<td>22.2</td>
</tr>
<tr>
<td>Secondary level</td>
<td>52</td>
<td>57.8</td>
</tr>
<tr>
<td>Tertiary level; (colleges, polytechnics)</td>
<td>9</td>
<td>10.0</td>
</tr>
<tr>
<td>University level</td>
<td>7</td>
<td>7.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

From the Table 4.6 (57.8%) who were the majority of the household respondents had secondary level of education, 22.2% had primary, 10.0% had tertiary level while 2.2% had never stepped to school. Clearly the finding shows that majority had basic education therefore, they could read and write hence providing valid, reliable and consistent information about sustainability of water project in their locality.

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www.ijsrp.org
4.3.5 Occupation

The study sought to find out the occupation of the respondents.

**Table 4.7 Occupation**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock sale</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Vegetable sale</td>
<td>49</td>
<td></td>
</tr>
<tr>
<td>Charcoal sale</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Firewood sale</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Carpentry</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Quarrying (sand/stone)</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Casual labour</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

From the results in Table 4.7, 60% of the respondents were casual labourers, 49% involved themselves in selling vegetables, 43% sold livestock, 33% sold charcoal, 28% sold firewood sale, 11% in carpentry, 14% they majored on quarrying while 8% were employed. Therefore the majority of the respondents earn their living from informal sector.

4.3.6 Average Income Range Per Month

The study sought to establish out the respondents’ income range monthly from all their income sources combined.

**Table 4.8 Average Income Range Per Month**

<table>
<thead>
<tr>
<th>Income Range</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 2500</td>
<td>20</td>
<td>22.2</td>
</tr>
<tr>
<td>2500 – 5000</td>
<td>50</td>
<td>55.6</td>
</tr>
<tr>
<td>5000 – 7500</td>
<td>14</td>
<td>15.6</td>
</tr>
<tr>
<td>7500 – 10000</td>
<td>4</td>
<td>4.4</td>
</tr>
</tbody>
</table>
From the Table 4.8, many of the households in Makueni County (55.6%) had an average monthly income of Ksh. 2500 – 5000, 22.2% earned Ksh. < 2500 while 15.6% earned an average monthly income of Ksh. 5000 – 7500. Therefore 77.8% the majority of the households were earning less than Ksh. 7500.

**4.4 Stakeholders’ Participation and the Sustainability of the Water Projects**

The first objective of the study was to establish how the extent of stakeholders’ participation affects the sustainability of the water projects.

**4.4.1 Participation in the Initiation of Water Projects**

The study sought to investigate whether the household’s respondents had ever involved in project initiation in this area (Kikumbulyu South and North).

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>35</td>
</tr>
<tr>
<td>No</td>
<td>55</td>
</tr>
</tbody>
</table>

From the results of the study in Table 4.9, the majority (61.1%) of the households’ respondents were never involved themselves in the initiation of the water projects while only 38.9% actively participated in the initiation of Kwing’ithya Kiw’u water projects. This shows that stakeholders’ participation in the water projects was low.

**4.4.2 Stakeholders’ Involvement in Water Project Operation**

The respondents were required to indicate whether other stakeholders were involved in the water projects in this area.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>70</td>
</tr>
<tr>
<td>No</td>
<td>20</td>
</tr>
</tbody>
</table>

From the results of the study in Table 4.10, the majority (77.8%) of the households’ respondents involved other stakeholders in the water projects while only 22.2% did not involve other stakeholders.
According to the findings in Table 4.11, majority (77.8%) of the respondents indicated that other stakeholders were involved in the Kwing’ithya Kiw’u water project in this area. This explains that involvement of the stakeholders determined the sustainability of the water projects.

### 4.4.3 Stakeholders’ Participation Positive Contribution to the Sustainability of the Water Projects

The respondents asked to identify the extent that the stakeholders’ participation positively enhanced the sustainability of the water projects.

<table>
<thead>
<tr>
<th>Table 4.11 Stakeholders’ Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>To a very low extent</td>
</tr>
<tr>
<td>To a low extent</td>
</tr>
<tr>
<td>To a moderate extent</td>
</tr>
<tr>
<td>To a great extent</td>
</tr>
<tr>
<td>To a very great extent</td>
</tr>
</tbody>
</table>

Table 4.11 shows most of the household respondents (50.0%) revealed that stakeholders’ participation positively enhanced the sustainability of the water projects to a great extent, 27.8% to a very great extent while 16.7% to a moderate extent, finally, 5.5% to a very and low extent. Therefore it is evident stakeholders’ participation enhanced the efficiency of the water project to a great extent consequently improving the sustainability of the water project.

### 4.4.4 Stakeholders’ Participation and Sustainability of the Water Projects

The study inquired from the respondents the influence of stakeholders’ participation on the sustainability of the rural community based water projects. The respondents were required to indicate their level of agreement on the extent to which stakeholders’ participation affected the sustainability of the water projects. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree 3 - Neutral 4- Agree and 5- Strongly Agree. SPSS was used to generate the mean and standard deviations as illustrated in Table 4.11.

| Table 4.12 Stakeholders’ Participation and Sustainability of the Water Projects |
| Statements | Mean |
| Target communities involvement is important for the sustainability of rural water supply systems | 4.09 |
Stakeholders’ support has ensured that participants are actively involved in project planning and implementation or through formal or informal training and consciousness-raising activities.  

Stakeholders’ involvement in the project implementation has enhanced continuity in the operation of the water project.  

Stakeholders’ participation has enabled them to clearly understand their roles.  

Stakeholder are better placed to lobby for government and donor support for the community project.  

By the Stakeholders’ support, the community ensures the success of a project through collective efforts to increase and exercise control over project.  

Stakeholders influence and share control over water development initiatives, and the decisions (e.g. for expansion, operation and maintenance) and resources which affect them.  

Stakeholders support ensure that community project are managed effectively, minimizing wastes and thereby ensuring their sustainability more so financial sustainability.  

Stakeholders’ support brings together individuals, families, or communities who assume responsibility for their own welfare (ownership).  

Stakeholders’ contribution influences the direction and execution of water development projects rather than merely receive a share of project benefits.  

Community support has increased project efficiency.  

Building a partnership with the communities lead towards improving the people’s problem solving capacities.  

From the study findings, the majority of the respondents agreed that; stakeholders’ support has ensured that participants are actively involved in project planning and implementation or through formal or informal training and consciousness-raising activities (M=4.39), stakeholders’ participation has enabled them to clearly understand their roles (M=4.23), involvement of the target communities is crucial for the sustainability of rural water supply systems (M=4.09), stakeholders influence and share control over water development initiatives, and the decisions (e.g. for expansion, operation and maintenance) and resources which affect them (M=4.05), by the Stakeholders’ support, the community ensures the success of a project through collective efforts to increase and exercise control over project (M=4.03), building a partnership with the communities lead towards improving the people’s problem solving capacities.
solving capacities (M=4.01), stakeholders are better placed to lobby for government and donor support for the community project (M=3.89), community support has increased project efficiency (M=3.87), stakeholders’ contribution influences the direction and execution of water development projects rather than merely receive a share of project benefits (M=3.56), stakeholders support ensure that community projects are managed effectively, minimizing wastes and thereby ensuring their sustainability more so financial sustainability (M=3.06), stakeholders’ support brings together individuals, families, or communities who assume responsibility for their own welfare (ownership) (M=3.01), stakeholders’ involvement in the project implementation has enhanced continuity in the operation of the water project (M=2.43) respectively.

4.4.5 Stakeholders’ Involvement in the Project

The study sought to find out from the water project employees on whether the stakeholders were adequately involved in the project.

<table>
<thead>
<tr>
<th>Table 4.13 Stakeholders’ Involvement in the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The results in Table 4.13, many of the water project employees (75%) confessed that the stakeholders were not adequately involved in the project. Only 25% of the water project employees attested to the stakeholders being adequately involved in the water project. Therefore, it is evident the lack of sufficient will of stakeholders’ participation in the project implementation contributed to the project failure.

4.5 Cultural Practices and Sustainability of Water Projects

This was the second objective of the study which was to assess how cultural practices influence sustainability of the water projects.

4.5.1 Cultural Practices and Sustainability of the Water Projects

The study sought to find out the influence of cultural practices on the sustainability of the water projects. The respondents were required to show their level of agreement on the extent to which various cultural practices affected the sustainability of the water projects. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree 3 - Neutral 4 - Agree and 5 - Strongly Agree. SPSS was used to generate the mean and standard deviations were generated as illustrated in Table 4.14.

<table>
<thead>
<tr>
<th>Table 4.14 Cultural Practices and Sustainability of the Water Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statements</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>People from different backgrounds in the region benefit from the water project</td>
</tr>
<tr>
<td>The water project unites people from different cultures/backgrounds in the region</td>
</tr>
</tbody>
</table>
The water project promotes social networks amongst communities in the region 3.26

The water project has enhanced partnerships between the local community and the government or non-governmental organizations 3.26

The water project builds community identity 3.54

Through the water project the cultural norms are maintained in the community around 3.52

The water project has positively transformed health, water and sanitation practices in the region 4.57

The water project has enhanced participation of local communities in development initiatives in the region 4.53

The project has improved security in the region by reducing clashes over natural sources of water 4.27

The project has encouraged residents to take ownerships of their own community resources 4.37

The water project has encouraged residents to take care of available water resources and other natural resources 4.23

The community has acquired substantial knowledge and technical skills from the water project 4.01

From the study results, the majority of the respondents agreed that the water project has positively transformed health, water and sanitation practices in the region (M=4.57), the water project has facilitated participation of local communities in development initiatives in the region (M=4.53), the project has encouraged residents to take ownerships of their own community resources (M=4.37), the project has improved security in the region by reducing conflicts over natural sources of water (M=4.27), the water project has encouraged residents to conserve available water resources and other natural resources (M=4.23), the community has gained substantial knowledge and technical skills from the water project (M=4.01), the water project unites people from different cultures/tribes/clans in the region (M=3.66), the water project builds community identity and pride (M=3.54), through the water project the cultural norms are upheld in the community around (M=3.52), the water project promotes social networks amongst residents in the region (M=3.26), the water project has enhanced partnerships between the local community and the government or non-governmental organizations (M=3.26), and that people from different cultures/tribes/clans in the region benefit from the water project (M=2.42) respectively.
4.5.2 Effect of Cultural Practices on the Project

The study further solicited information from the water project employees on how they would rate the effect of cultural practices in the project.

<table>
<thead>
<tr>
<th>Effect of Cultural Practices on the Project</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Good</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Fair</td>
<td>6</td>
<td>30.0</td>
</tr>
<tr>
<td>Poor</td>
<td>9</td>
<td>45.5</td>
</tr>
<tr>
<td>Very poor</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.15 reveals that most of the water project employees (45.5%) rated the effect of cultural practices in the project as poor, 30% as fair while 10% rated it as very poor.

4.6 Management Skills and Sustainability of the Water Projects

The third objective of the study was to examine how management skills hinder sustainability of the water projects.

4.6.1 Managers of the Water Point

The household respondents were supposed to indicate who managed the water points.

<table>
<thead>
<tr>
<th>Managers of the Water Points</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Committee</td>
<td>45</td>
<td>50.0</td>
</tr>
<tr>
<td>An elected leader</td>
<td>30</td>
<td>33.3</td>
</tr>
<tr>
<td>Headman</td>
<td>9</td>
<td>10.0</td>
</tr>
<tr>
<td>Politician</td>
<td>6</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

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As shown in Table 4.16, 50.0% of the household respondents acknowledged that the water points were managed by a committee, 33.3% by elected leader, 10.0% by headman and 6.7% indicated that water point were managed by political leaders.

### 4.6.2 Responding to Concerns

The household respondents were required to indicate whether those who were entrusted with management of the water project responded adequately to concerns whenever raised.

<table>
<thead>
<tr>
<th>Table 4.17 Responding to Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

Table 4.17 shows that the majority of the household respondents (66.7%) said water managers responded adequately to concerns raised by community members. Only 33.3% didn’t respond to concerns whenever raised.

### 4.6.3 Efficiency of the Water Project Managers

This was to measure the efficiency of water project managers.

<table>
<thead>
<tr>
<th>Table 4.18 Efficiency of the Water Project Managers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

From the findings of the study in Table 4.18, the majority of the household respondents (66.7%) said that the people appointed to manage the water project were effective while 33.3% said that the people appointed to manage the water project were ineffective.

### 4.6.4 Management Skills and Sustainability Water Projects on Likert Scale

The study sought to find out the influence of management skills on the sustainability of the water projects. The respondents were requested to indicate their level of agreement on the extent to which various management skills affected the sustainability of the water projects. The responses were rated on a five point Likert scale where: 1 - Strongly Disagree 2 - Disagree 3 - Neutral 4- Agree and 5- Strongly Agree. SPSS was used to generate the mean and standard deviations as illustrated in Table 4.19.

| Table 4.19 Management Skills and Sustainability of the Water Projects |
There is enough technical expertise to manage the project 4.01

Project managers have adequate and experience in management 3.69

There is enough human resource for sustainability of the project 3.88

Technical architecture advice was made available for the project 3.60

Estimates in the project schedule and budget are clear and achievable 3.66

Risk management is satisfactory 3.77

There is adequate leadership skills of the managers 3.63

Community Members are satisfied with the overall management of the water project 3.79

Management of projects has increased the alignment of development projects with host communities priorities 3.71

Community based projects are more complex and require multifaceted management skills 3.65

From Table 4.19 the majority of the respondents admitted that there is sufficient technical expertise to manage the project (M=4.01), there is adequate human resource for sustainability of the project (M=3.88), the community is satisfied with the overall management of the water project (M=3.79), risk management is satisfactory (M=3.77), management of projects has increased the alignment of development projects with host communities priorities (M=3.71), project managers have adequate and experience in management (M=3.69), there are clear and achievable estimates in the project schedule and budget (M=3.66), community based projects are complex and require multifaceted management skills (M=3.65), there is adequate leadership skills of the managers (M=3.63), and that Technical architecture advice was made available for the project (M=3.60) respectively.

4.6.5 Management Qualities Affecting Sustainability of the Rural Community Based Water Projects

For further establishment of the influence of management skills on the sustainability of the water projects, the water project employees were questioned to indicate their level of agreement on the extent to which the management possessed various qualities and skills that could affect the sustainability of the water projects. The responses were rated on a five point Likert scale where: 1 = not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent. SPSS was used to generate the mean and standard deviations as illustrated in Table 4.19.
Table 4.20 Management Qualities Affecting Sustainability of the Water Projects

<table>
<thead>
<tr>
<th>Management qualities</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical expertise</td>
<td>4.40</td>
</tr>
<tr>
<td>Task familiarity</td>
<td>3.13</td>
</tr>
<tr>
<td>Resources Management</td>
<td>4.26</td>
</tr>
<tr>
<td>Technical architecture Advise</td>
<td>4.18</td>
</tr>
<tr>
<td>Estimating project schedule and budget</td>
<td>3.16</td>
</tr>
<tr>
<td>Ascertaining and risk management</td>
<td>3.15</td>
</tr>
<tr>
<td>Business Knowledge</td>
<td>3.89</td>
</tr>
<tr>
<td>Leadership Skills</td>
<td>3.51</td>
</tr>
</tbody>
</table>

From the results of Table 4.20, many of the respondents agreed that the management qualities that hindered the sustainability of the rural community based water projects were technical expertise (M=4.40), resource management (M=4.26), technical architecture advise (M=4.18), business knowledge (M=3.89), leadership (M=3.51), estimating project schedule and budget (M=3.16), ascertaining and managing risks (M=3.15) and (task familiarity) (M=3.13) respectively.

4.7 Technology and Sustainability of the Water Project

The last objective of the study was to determine how technology hinders sustainability of the water projects.

4.7.1 Technology Used to Pump Water

The household respondents were to state on which technology was used to get water from the points/sources identified.

Table 4.21 Technology Used to Pump Water

<table>
<thead>
<tr>
<th>Source of Water</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>By use of pulley</td>
<td>50</td>
<td>55.6</td>
</tr>
<tr>
<td>Use of pumps to pump out of source to storage tanks</td>
<td>30</td>
<td>33.3</td>
</tr>
<tr>
<td>Water piping to all households</td>
<td>10</td>
<td>11.1</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>100</td>
</tr>
</tbody>
</table>
The results from Table 4.21 revealed that, the majority of the (55.6%) employed pulley technology to access water from the points/sources, 33.3% used water pumps while 11.1% indicated that water is piped to all households.

### 4.7.2 Meters Installation for Monitoring Water Consumption

The target was to investigate whether there were meters installed to monitor consumption of water, therefore households respondents had to provide the answers.

<table>
<thead>
<tr>
<th>Table 4.22 Meters Installed to Monitor Consumption of Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

From the results from Table 4.22 the majority of the household respondents (80%) said that no meters had been installed to monitor consumption of water. Only 20% attested that meters had been installed to monitor consumption of water. Therefore, there was a low level of adoption of technology in the management of water project hence impairing the sustainability of water projects.

### 4.7.3 Water Payment Mode

The household respondents were required to indicate the various mode of payment that they used to pay for the water bills.

<table>
<thead>
<tr>
<th>Table 4.23 Water Payment Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Mobile money payment (Mpesa and Airtel money)</td>
</tr>
<tr>
<td>Bank account</td>
</tr>
<tr>
<td>Cash</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

As per the findings in Table 4.23 most of the household respondents (57.8%) paid for water using cash, 28.9% using mobile money payment (Mpesa, and Airtel money) while 13.3% used bank account. This clearly indicates amount of liquid cash which was handled by management of the water projects.

### 4.7.4 Challenges Affecting Constant Supply of the Water

The household respondents were required to indicate the various challenges affecting constant supply of the water to the households from the water points.
### Table 4.24 Challenges Affecting Constant Supply of the Water

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes Breakage</td>
<td>44</td>
</tr>
<tr>
<td>Vandalism</td>
<td>31</td>
</tr>
<tr>
<td>Pipes blockages</td>
<td>23</td>
</tr>
<tr>
<td>Breakdown of generator pumps</td>
<td>45</td>
</tr>
<tr>
<td>Expensive parts/fuel</td>
<td>56</td>
</tr>
</tbody>
</table>

According to the results in Table 4.24, expensive parts/fuel (56%) was the main challenge affecting constant supply of the water to the households from the water points, breakdown of generator pumps (45%), pipes breakages (44%), vandalism (31%) and pipes blockages (23%) respectively.

### 4.7.5 Technology and Sustainability of Water Project

The household respondents were required to indicate whether technology has influenced efforts to achieve sustainability of the water projects.

#### Table 4.25 Technology and Sustainability of the Water Project

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>15</td>
<td>75</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

According to the results in Table 4.24, majority of the water project employees (75%) attested to technology influencing efforts to achieve sustainability of the water project. While (25%) didn’t agree with whether technology was a critical factor affecting the sustainability of the community based water project.

### 4.7.6 Forms of Technology Used in Rural Community Based Water Projects

In order to further to establish how technology hinders sustainability of the water projects, the water project employees were requested to show their level of agreement on the extent to which various forms of technology were used in the rural community based water projects. The responses were rated on a five point Likert scale where: 1 = not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent. SPSS was used to generate the mean and standard deviations as illustrated in Table 4.25.
From the findings in Table 4.25, majority of the respondents attested that information communication systems were mostly used (M=4.39), accounting systems (M=4.26) followed, service delivery (M=4.23), fault reporting (M=4.15), reporting systems (M=4.13), and finally payment systems (M=4.12) respectively.

### 4.7.7 Technology and Projects’ Sustainability Using Likert Scale

In order to investigate further to establish how technology hinders sustainability of the water projects, the water project employees were requested to indicate the extent to which various aspects of technology hindered the water projects sustainability. The responses were rated on a five point Likert scale where: 1 = not at all, 2 = little extent, 3 = moderate extent, 4 = great extent and 5 = very great extent. SPSS was used to generate the mean and standard deviations as illustrated in Table 4.26.

#### Table 4.27 Technology and Projects’ Sustainability

<table>
<thead>
<tr>
<th>Technologies</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumping technology</td>
<td>4.23</td>
</tr>
<tr>
<td>Spare parts availability</td>
<td>3.87</td>
</tr>
<tr>
<td>Payment systems</td>
<td>4.01</td>
</tr>
<tr>
<td>Choice of tech (Solar energy vs. Generator, borehole, dams, water pans)</td>
<td>4.03</td>
</tr>
<tr>
<td>Service delivery</td>
<td>3.06</td>
</tr>
<tr>
<td>Fault reporting</td>
<td>3.00</td>
</tr>
</tbody>
</table>

As per the findings in Table 4.26, many of the respondents attested that the various aspects of technology hindered the water projects sustainability which included; pumping technology (M=4.23), choice of tech (Solar energy vs. Generator, borehole, dams, water pans)
(M=4.03), payment systems (M=4.01), spare parts availability (M=3.87), and finally service delivery (M=3.06) and fault reporting (M=3.00) in that order.

### 4.7.8 Sustainability of Water Projects

The study required the water project employees to indicate whether they considered the water projects in the area to be sustainable.

<table>
<thead>
<tr>
<th>Table 4.28 Sustainability of Water Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Table 4.28 indicates that majority of the water project employees attested that the water projects in the area were not sustainable while 35% said that the water projects in the area were sustainable. This illustrates that the sustainability of majority of water project in Makueni County was low. Water project employees gave the following indicators of sustainability which included reduced cost of running the project improved access to water by the area residents, and environmental protection and conservation.

According to the water project employees the main factors contributing to sustainability were adoption of modern technology, full stakeholders’ participation, good management of the water project by qualified and professionals and integration of local community culture in the planning and implementation of the project. The water project employees attested that for water projects to be sustainable the following should be put into considerations; stakeholders’ participation, cultural practices, management skills and practices and finally use of modern technology in the running of the project.

### 4.8 Inferential Statistics

#### 4.8.1 Correlation Analysis

Karl Pearson’s coefficient of correlation was employed to quantify the strength of the relationship between the variables used in the study.

The Pearson product-moment correlation coefficient measures the strength of a linear association between two variables and is denoted by $r$. The Pearson correlation coefficient, $r$, takes a range of values from -1 to +1. 0 indicates the two variables are independent. A positive value indicates a positive association. A negative value indicates negative association, that is, as the value of one variable increases the value of the other variable decreases.

| Table 4.29: Correlation and the coefficient of determination |
|---|---|---|---|---|
| Project sustainability | Stakeholders’ participation | Management skills | Cultural practices | Technology influence |
4.8.2 Relationship between Stakeholders’ Participation and Sustainability of Water Projects

From Table 4.28, it is evident that there is a positive relationship between water project sustainability and stakeholders’ participation of magnitude 0.894. The positive relationship indicates that there is a correlation between the factors hindering sustainability of water projects in Kikumbulyu South and North, Makueni County, Kenya with stakeholders’ participation leading with the highest value (0.894). This factor had a significant p-value (p<0.05) at 95% confidence level. Stakeholders’ participation was the most significant factor. Since this factor is <0.05 then there is statistically significant relationship between stakeholders’ participation and sustainability of water projects.

4.8.3 Relationship between Cultural Practices and Sustainability of Water Projects

From Table 4.28, it is evident that there is a positive relationship between water project sustainability and cultural practices of magnitude 0.661. The positive relationship indicates that there is a correlation between the factors hindering sustainability of water projects in Kikumbulyu South and North, Makueni County, Kenya. This factor had a significant p-value (p<0.05) at 95% confidence level. Since this factor is <0.05 then there is statistically significant relationship between cultural practices and sustainability of water projects.

4.8.4 Relationship between Management Skills and Sustainability of Water Projects

From Table 4.28, it is evident that there is a positive relationship between water project sustainability of magnitudes 0.493. The positive relationship indicates that there is a correlation between the factors hindering sustainability of water projects in Kikumbulyu South and North, Makueni County, Kenya. This factor had a significant p-value (p<0.05) at 95% confidence level. Since this factor is <0.05 then there is statistically significant relationship between management skills and sustainability of water projects.

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<table>
<thead>
<tr>
<th>Project</th>
<th>Sustainability (r) (p) Sig. (2 tailed)</th>
<th>Stakeholders’ participation (r) (p) (2 tailed)</th>
<th>Management skills (r) (p) Sig. (2 tailed)</th>
<th>Cultural practices (r) (p) Sig. (2 tailed)</th>
<th>Technology influence (r) (p) Sig. (2 tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.000</td>
<td>0.894 0.018</td>
<td>0.493 0.031 0.316 0.047</td>
<td>0.661 0.024 0.163 0.019 0.216 0.047</td>
<td>0.402 0.046 0.161 0.029 0.233 0.0464 0.014</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.1.1 Stakeholders’ Participation and Sustainability of Water Projects

The study established that the majority (61.1%) of the community members never participated in the initiation of the water projects. Thus level of stakeholders’ participation in the water projects was low which affected the sustainability of water project. The household participated in the initiation of the water projects when they were consulted through a meeting, contribution of building materials and as leaders of the committees. This implies that the stakeholders’ participation was critical in the implementation of the water projects in the county. The involvement of the all the stakeholders determined the efficiency and sustainability of the water projects.

The stakeholders’ participation positively enhanced the sustainability of the water projects to a great extent. Therefore the stakeholders’ participation enhanced the efficiency of the water project to a great extent consequently improving the sustainability of the project. The stakeholders were not adequately involved in the project. Therefore the lack of sufficient stakeholders’ participation in the project implementation contributed to the project failure.

The study also revealed that; stakeholders’ support has ensured that participants are actively involved in project planning and implementation or through formal or informal training and consciousness raising activities (M=4.39), stakeholders’ participation has enabled them to clearly understand their roles (M=4.23), involvement of the target communities is crucial for the sustainability of rural water supply systems (M=4.09), stakeholders influence and share control over water development initiatives, and the decisions (e.g. for expansion, operation and maintenance) and resources which affect them (M=4.05), by the Stakeholders’ support, the community ensures the success of a project through collective efforts to increase and exercise control over project (M=4.03), building a partnership with the communities lead towards improving the people’s problem solving capacities (M=4.01), stakeholder are better placed to lobby for government and donor support for the community project (M=3.89), community support has increased project efficiency (M=3.87), stakeholders’ contribution influences the direction and execution of water development projects rather than merely receive a share of project benefits (M=3.56), stakeholders support ensure that community project are managed effectively, minimizing wastes and thereby ensuring their sustainability more so financial sustainability (M=3.06), stakeholders’ support brings together individuals, families, or communities who assume responsibility for their own welfare (ownership) (M=3.01), stakeholders’ involvement in the project implementation has enhanced continuity in the operation of the water project (M=2.43) respectively.

5.1.2 Cultural Practices and Sustainability of Water Projects

From the study findings, the study established that water project has positively transformed health, water and sanitation practices in the region (M=4.57), the water project has facilitated participation of local communities in development initiatives in the region (M=4.53), the project has encouraged residents to take ownerships of their own community resources (M=4.37), the project has improved security in the region by reducing conflicts over natural sources of water (M=4.27), the water project has encouraged residents to conserve available water resources and other natural resources (M=4.23), the community has gained substantial knowledge and technical skills from the water project (M=4.01), the water project unites people from different cultures/tribes/clans in the region (M=3.66), the water project builds community identity and pride (M=3.54), through the water project the cultural norms are upheld in the community around (M=3.52), the water project promotes social networks amongst residents in the region (M=3.26), the water project has enhanced partnerships between the local community and the government or non-governmental organizations (M=3.26), and that people from different cultures/tribes/clans in the region benefit from the water project (M=2.42) respectively.
5.1.3 Management Skills and Sustainability of the Water Projects

The study established that those who managed the water project responded adequately to concerns whenever raised. The people appointed to manage the water project were effective. The study also found out that there is sufficient technical expertise to manage the project (M=4.01), there is sufficient human resource for sustainability of the project (M=3.88), the community is satisfied with the overall management of the water project (M=3.79), risk management is satisfactory (M=3.77), management of projects has increased the alignment of development projects with host communities priorities (M=3.71), project managers have adequate and experience (task familiarity) in management (M=3.69), there are clear and achievable estimates in the project schedule and budget (M=3.66), community based projects are complex and require multifaceted management skills (M=3.65), the leadership skills of the managers is satisfactory (M=3.63), and that advise about technical architecture was made available for the project (M=3.60) respectively. The study established that the management qualities that affected the sustainability of the rural community based water projects were technical expertise (M=4.40), managing resources (M=4.26), advising about technical architecture (M=4.18), knowledge of business (M=3.89), leadership (M=3.51), estimating project schedule and budget (M=3.16), ascertaining and managing risks (M=3.15) and experience (task familiarity) (M=3.13) respectively.

5.1.4 Technology and Sustainability of the Water Project

The study revealed that in the majority of the household there were no meters installed to monitor consumption of water. Therefore, the level of adoption of technology in the management of water project was very low impairing the sustainability of water projects. There were various payment modes used in the management of the water projects such as cash, mobile money payment (Mpesa, and Airtel money) and bank account.

The challenges affecting constant supply of the water to the households form the water points expensive parts/fuel (56%) was the main challenge affecting constant supply of the water to the households from the water points, breakdown of generator pumps (45%), pipes breakages (44%), vandalism (31%) and pipes blockages (23%) respectively.

The water project suffered major setbacks due to breakdown as the local artisans who were relied on lacked adequate skills to maintain the water project. The sustainability of the water projects in the county was highly affected by lack of modern technology required in the running of the project as the local community was not fully equipped with adequate skills.

The study established that the forms of technology used in the rural community based water projects included information communication systems (M=4.39), accounting systems (M=4.26), service delivery (M=4.23), fault reporting (M=4.15), reporting systems (M=4.13), payment systems (M=4.12) respectively. Other aspects of technology influencing the projects sustainability included; pumping technology (M=4.23), choice of tech (Solar energy vs. Generator, borehole, dams, water pans) (M=4.03), payment systems (M=4.01), spare parts availability (M=3.87), service delivery (M=3.06) and fault reporting (M=3.00) respectively.

The study established that there were various policies or measures either initiated or undertaken by the department to ensure proper: utilization, conservation, planning or management of the water projects. However the policies were not fully implemented owing to lack of financial resources, lack of support by the top management, lack of community ownership of the project and lack of skilled manpower to run the water projects.

The indicators of sustainability included improved access to water by the area residents, reduced cost of running the project and environmental protection and conservation. The main factors contributing to sustainability were; use of modern technology, full participation by the stakeholders, proper management of the water project by qualified personnel and integration of local community culture in the planning and implementation of the project. The sustainability of community based projects was dependent on included stakeholders’ participation, cultural practices, use of best management skills and practices by the managers of the projects and adoption of modern technology in the running of the project.

5.2 Conclusions

The study concluded that the majority of the community members never participated in the initiation/start of the water projects. Thus, level of stakeholders’ participation in the water projects was low which hindered the sustainability of water project. The household participated in the initiation/start of the water projects when they were consulted through a meeting, contribution of building materials and as leaders of the committees. This implies that the stakeholders’ participation was critical in the implementation of the water projects in the county. The involvement of the all the stakeholders determined the efficiency and sustainability of the water projects.
The stakeholders were involved in the water project through contribution of funds/other resources, through designing and in management/running of the operation of the rural community based water projects. Thus the stakeholders brought many contributions to the running of the water projects in terms of financial supports, designing of the project and the operation of the water projects. The stakeholders’ participation positively enhanced the sustainability of the water projects to a great extent. The main benefit associated with stakeholders’ participation in the project was continuity of the project, timely maintenance/repairs, harmony/conflict management, strong ownership of the projects, better service delivery and expansion of the project. The stakeholders were not adequately involved in the project. Therefore the lack of sufficient stakeholders' participation in the project implementation contributed to the project failure. In decision making the stakeholders endorsed the project budgetary allocations, vetted the employees to work in the project, proposed the policies to be implemented. In the sharing of development activities the stakeholders approached strategic personalities and institutions to aid in management of the project, and in lobbying for support from the government and private sector.

The study also concluded that; stakeholders’ support ensured that participants were actively involved in project planning and implementation, improved the projects ownership by the community, enhanced the sustainability of rural water supply systems through sharing control over water development initiatives, and the decisions and helped in building a partnership with the communities lead towards improving the people’s problem solving capacities as well as helped in lobbying for government and donor support for the community project.

From the study findings, the study concluded that water project has positively transformed health, water and sanitation practices in the region, facilitated participation of local communities in development initiatives in the region, encouraged residents to take ownerships of their own community resources, improved security in the region by reducing conflicts over natural sources of water, encouraged residents to conserve available water resources and other natural resources, as well as helped the community gained substantial knowledge and technical skills from the water project. It has also united people from different cultures/tribes/clans in the region, builds community identity and pride and helped to uphold cultural norms as well as promoted social networks amongst residents in the region. The water project has enhanced partnerships between the local community and the government or non-governmental organizations as well as people from different cultures/tribes/clans in the region benefit from the water project.

The study concluded that those who managed the water project responded adequately to concerns whenever raised. The people appointed to manage the water project were effective. The study also found out that there is sufficient technical expertise to manage the project, there is sufficient human resource for sustainability of the project, the community is satisfied with the overall management of the water project, risk management is satisfactory, management of projects has increased the alignment of development projects with host communities priorities, project managers have adequate and experience (task familiarity) in management, there are clear and achievable estimates in the project schedule and budget, water projects are complex and require multifaceted management skills, the leadership skills of the managers is satisfactory, and that advise about technical architecture was made available for the project.

The study concluded that the management qualities that hindered the sustainability of the water projects were technical expertise, managing resources, advising about technical architecture, knowledge of business, leadership, estimating project schedule and budget, ascertaining and managing risks and experience.

The study concluded that the level of adoption of technology in the management of water projects was very low impairing the sustainability of water projects. There were various payment modes used in the management of the water projects such as cash, mobile money payment (Mpesa and Airtel money) and bank account.

The challenges affecting constant supply of the water to the households form the water points expensive parts/fuel, breakdown of generator pumps, breakage of pipes, vandalism and blockages of pipes respectively. The sustainability of the water projects in the county was highly affected by lack of modern technology required in the running of the project as the local community was not fully equipped with adequate skills. Technology was therefore a critical factor affecting the sustainability of the community based water project.

The study concluded that the forms of technology were used in the rural community based water projects included information communication systems, accounting systems, service delivery, fault reporting, reporting systems, and payment systems. The various aspects of technology influenced the projects sustainability included; pumping technology, choice of tech, payment systems, spare parts availability, service delivery and fault reporting. However, the adoption of the technology in the water project was minimal.
5.3 Recommendations

5.3.1 Stakeholders’ Participation and Sustainability of Water Projects

The study concluded that the majority of the community members never participated in the initiation/start of the water projects. Thus, level of stakeholders’ participation in the water projects was low which hindered the sustainability of water project. Therefore, the level of stakeholders’ participation in the project planning and implementation should be increased to enhance the sustainability of the water projects in the county.

5.3.2 Cultural Practices and Sustainability of Water Projects

The government should institute stringent measures to deal with persons vandalizing the community water project. This should be coupled with improved security offered by the security agencies to mitigate the cases of vandalism.

5.3.3 Management Skills and Sustainability of Water Projects

The water projects should be managed by highly competent personnel to increase its efficiency and sustainability.

5.3.4 Technology and Sustainability of Water Project

The study concluded that the level of adoption of technology in the management of water projects was very low impairing the sustainability of water projects. Therefore the project management should seek to adopt modern technology through increased budgetary allocations.

5.4 Suggestions for Future Studies

The current study only focused on four aspects of sustainability of water projects: stakeholders’ participation, cultural practices, management skills and technology influences. There are other aspects hindering water projects sustainability for example political will, sufficient funding e.t.c. Future studies should examine these aspects. The study was also limited to answering questions regarding what relationship existing between the project aspects and sustainability of water projects, and the direction of these relationships because of the quantitative approach used. It could not provide answer regarding why these relationships exist. A qualitative in depth study is needed to uncover the reason behind these relationships.

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Managing through a crisis: Effects of nCovid 19 and the significance of organisational slack resources in strategic agility.

A case of Zimbabwe Tourism and Hospitality Industry

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Abstract - This study examined the effects of nCovid 19 on the Tourism and Hospitality firms and assessed the significance of organisational slack resources in mitigating these effects. Research data obtained from 260 respondents was analysed statistically. The findings depicted some debilitating effects of the pandemic on business key performance indicators. More critically, analysis showed the essence of organisational slack resources in ameliorating the effects of pandemic on the business. Organizations with slack resources at their disposal were found to be more agile in face of an operational jolt posed by nCovid 19. Firms were recommended to maintain an optimum threshold of absorbed and unabsorbed slack resources. Robust corporate strategies such as organisational ambidexterity were suggested to foster dexterity of firms when faced with vagaries of the dynamic operating environment

Index Terms - absorbed slack resources, nCovid 19 pandemic, strategic agility, tourism, unabsorbed slack resources,

INTRODUCTION

The outbreak of novel Covid-19, a special type of the Corona virus has disrupted the normal flow of business at a global level. The virus, first discovered in the Chinese city of Wuhan in December 2019, spreads to become a global pandemic. By September 2020, it had claimed over a million lives globally. The virus has brought unprecedented direct and indirect afflictions on humanity. As researchers in various fields such as microbiology, epidemiology and medicine continue to explore solutions, the virus continue to wreak havoc on the business front imposing the “new normal of doing business”. The novelty of the virus calls for research to examine and quantify its impact on business operations. The key test was on the role played by organisational slack resources on the responsive of businesses when faced with a crisis like the one brought by nCovid-19. In various countries, available literature shows attempts that have been made to assess the impact of the pandemic in different spheres of life. Historically, pandemics have often disrupted business operations as evidenced by the various studies that explored the implications of the Spanish Flu of 1918. Swift (2009) acknowledged that measuring the full impact of the Spanish Flu was difficult due to the cofounding war effects as European countries were just emerging from the First World War. Nonetheless, the number of deaths confirmed that this was indeed a very serious pandemic. With regard to business operations, it has been noted that pandemics usually affect both supply and demand variables in the markets Swift (2009). In the same vein, Qiu, Rutherford, Mao and Chu (2017) admitted that during pandemics there is always a sharp decline in the number of hours committed to productive work. The major drivers in the decline in hours of work include a fall in aggregate demand, illness and fear of infections. The paper categorically explored effects of Covid-19 on business operations and the role of slack resources in managing agility among players in the tourism and hospitality sector in Zimbabwe. A number of variables were used to measure the implications of Covid-19 on the business operations and these included variances in effective and nominal demand, revenue inflows, working capital, supply chain operations and operating profit. As the country recorded a steady growth in infections from both foreign transmissions and local transmissions, the government of Zimbabwe imposed the World Health Organization prescribed lockdown which shutdown the entire country. The study analyses were confined within the time limit of February to September 2020, which is dubbed the first peak period of Corona virus in Zimbabwe.
Literature review

What is a pandemic?

Honigsbaum (2009) defined a pandemic as a wide spread epidemic of contagious diseases throughout a country, continent or the whole globe. The medicineNet (visited on 20 September 2020) traces the meaning of the term pandemic from its Greek roots, “pan-“ for all + “demos” for all people or population = “pandemos” to mean all people. This means that in a pandemic all people are affected. On the contrary, Honigsbaum (2009) defined an epidemic as an outbreak that spreads throughout an area where the disease was not previously known. From the two definitions, the corona virus is an epidemic, which has become a pandemic. The World Health Organization declared that Corona Virus is a world pandemic on 30 January 2020 (WHO Report, 2020).

Effects of pandemics on business operations

Literature is awash with information on the impact of pandemics on the structure and performance of businesses at a country, regional and world level. Before the novel Corona virus, the influenza pandemic of 1918, termed the Spanish Flu’1 had the most catastrophic effects in the modern historic times. In a report by Garrett (2008), the Spanish Flu’1 killed over 40 million people worldwide from the early spring of 1918 through to late spring of 1919. Furthermore, documentary analysis suggested that firms in the United States saw their businesses declining by between 40 to 70% during the Spanish flu era (Garrett (2007, 2008). Apart from the Spanish Flue, Rassy and Smith (2013) documented the impact of Swine Flu that was commonly known as H1N1 on the Mexican tourism and pork industries in 2009. Rassy and Smith (2013) noted the debilitating impact of H1N1, which led to a serious decline in the poultry sector in South America. In 2010 the World Health Organisation reported that over 18 000 fatalities were confirmed from H1N1. This was believed to the reason for Mexican tourism industry failure to recover from the global economic crisis of 2008. In a separate study, Brown and Smith (2008) analysed the macro economic impact of the 2003 Severe Acute Respiratory Syndrome (SARS) which affected approximately 10 000 people across the globe and their submissions brought a better understanding of the need for a concerted effort when dealing with pandemics of this magnitude. A cross-sectional assessment of the previous pandemics and their impact on the operations of businesses can be closely related to the current nCovid-19 pandemic in terms of the impact on businesses performance. (Fernandes 2020). The UNDP (2020) posited Zimbabwe’s tourism sector as the key sector generating around US$1, 4 billion that is about 3.3 % of the economy. UNDP (2020:10) recorded that tour operators and hotels in the resort city of Victoria Falls for instance had reported 80 percent cancellations of business by early March 2020 and most hotels reduced business significantly leading to loss of jobs and income.

Zimbabwean Tourism and Hospitality nCovid 19 pandemic antecedents

Prior to nCovid 19, Zimbabwean Tourism and Hospitality sector had its own challenges.

Abel and Roux (2017) observed sectorial challenges associated with the issue of licenses, taxation and statutory fees. Various taxes were levied across the entire industry right from tour operators, transporters, air operators and hotels. The taxes include service tax, tax on transportation, aviation fees, operator’s fees to local authorities and relevant government departments. According to Abel and Roux (2017), the majority of the levies are levied for similar things but paid to different government departments. The Sunday News of 16/07/2017 reported a host of challenges faced by tourists visiting Zimbabwe as revealed by a tourist exit survey. The mentioned challenges include poor infrastructure, harassment at port of entry and high prices of services at the Zimbabwean destination. Kurambakuwa, Mudavanhu, Mauchi and Chingarande (2015) echoed similar sentiments noting inability of tourist to access some resorts due to lack of domestic air connectivity, poor rood network and unreliable railway network. All these factors weighed down tourism business prior to nCovid 19.
Other factors which negatively affected tourism included political instabilities, negative media publicity, economic problems and fuel shortages as shown by the below figure.

Figure 1.0 Factors affecting tourism in Zimbabwe

Adapted from Kurambakuwa et al (2015:73)

As indicated by the graph, negative publicity, political instability and economic recession have had a negative impact on the tourism industry (Kurambakuwa et al 2015). Interesting to note in the captioned figure is the fact that in 2015, disease epidemics were to a lesser extend a factor disturbing the Tourism industry. Fast forward to 2020, the factor is now under study as the chief culprit in grounding tourism activities. The above-discussed antecedents weaken the Tourism and Hospitality players from building the organisational slacks that would have become handy in fighting the nCovid pandemic.

Organizational Slack Resources

Bourgeois (1981: 30) exquisitely defined an organisational slack as a cushion of actual or potential resources, which allow an organisation to adapt successfully to internal pressure for adjustment or to external pressures for change in policy, as well as to initiate changes in strategy with respect to the external environment. Tan and Peng (2003) concurred with Bourgeois and further suggest that organisational slack is utilised within the organisation in four primary ways:
Firstly, it acts as a buffer to insulate the organization from the unexpected changes in the environment. Tan and Peng (2003) and Bourgeois (1981) noted that the vagaries of the meso and macro environment presented some jolts, which require in-built shocks in form of organizational slack. Secondly, the organizational slack resources can be used to encourage loyalty from the employees to the company by making payments to them in excess of what is required to maintain them in the organization Cyert and March (1963: 36). Thirdly, the slack can be used as resources for conflict resolution in that by using enough resources, any conflict over resources or its potential can be thwarted (Tan & Peng 2003). Finally Bourgeois (1981) highlighted that organizational slack can be utilized to facilitate the strategic behavior by enabling exploration of new markets and new product development, providing resources for innovation. Sharfman et al, (1988) stated that the purpose of slack is to allow the organization to forego short-term gains in favour of long-term gains. Slack resources are not committed to necessary expenditure, but are built up for future use. Teece, Peteraf and Leih (2016) weighed in with similar sentiments when they examined the impact of slack resources on the organizational agility. Teece, Peteraf and Leih (2016) highlighted that companies can allocate these slack resources to reduce the risk, that is slack resources are “natural hedges” to jolt amelioration. Luo (2017) resonates with earlier scholars and posits a positive direct relationship between availability of slack resources and corporate ambidexterity.

Organisational slack resources are differently categorised by scholars as noted by Bourgeois and Singh (1983) who argued that slack can be differentiated on an ease-of-recovery dimension; that is, a continuum representing how quickly the slack resource can be recovered for potential redeployment. Notably, classification of slack as financial resources dominates the literature, therefore there is need to go beyond focusing on financial aspects when defining slack resources (Geppert, 1996; Lawson, 2001; Meyer, 1982). Luo (2017) asserts that depending on the degree of flexibility, slack resources can be categorized as unabsorbed slack and absorbed slack. Cash and raw material inventory are good examples of unabsorbed slack. Mashina et al (2004) defined unabsorbed slack resources as those that are unused, readily available, and easily redeployed to various use. Absorbed slack refers to those internal resources embedded in firms as excess costs, which has a lower degree of flexibility and cannot be reconfigured for various uses as easy as unabsorbed slack (Bourgeois 1981). These resources include but not limited to skilled labour, flexible, multi-talented labour, excess machine capacity, which provide the firm with exploitative activities and improve firm performance. Luo (2017) highlighted that it is difficult to allocate absorbed slack in the short run, due to its low degree of flexibility.

**Strategic agility**

Strategic agility is a phrase formed by two key words, strategy and agility. Goldman’s (1995) defined strategic agility as a conscious and weighted answer of the organisation to unpredictable and continuous change in the business environment. Goldman’s (1995) revealed that strategic agility enables the organizations to grow and develop in a competitive environment. Doz and Kosonen (2008) cited in Razi and Hawajrej (2013) noted that strategic agility means to make fast turns and being able to transform the company without losing opportunities. Claub, Adebe and Gopgen (2091) concurred with earlier researchers and highlighted that strategic agility enables firms to make rapid changes while preserving their momentum. Strategic agility therefore, allows firms to engage in several renewal changes without the environmental changes as the antecedents. Claub et al (2019) postulates that strategic agility is proactive in nature, a feature that distinguish it from dynamic capabilities. Doz and Kosonen (2008) quoted in Claub et al (2019) mentioned the three particular capabilities that lay ground for strategic agility. These three are strategic sensitivity, leadership unity and resource fluidity. The concept of strategic agility is key in this study as well as its relationship with slack organisational resources.
Methodology

The study took a positivism epistemological approach dominated by descriptive and correlational tenets. A comprehensive sampling list of vibrant tourism players that spans from Aviation, Hotels & Restaurants, Tour operators, Car hire companies, Resort centres, Hunting & Safari operators, Art-Craft & Curio services was obtained from the Zimbabwe Tourism Authority. A sample of 320 players was randomly drawn from a list 1000 firms through a proportionate stratified randomised criterion to include all the Tourism and Hospitality sub-sectors. A closed ended questionnaire was electronically distributed to the targeted respondents with observation of all due axiological protocols. Initially a pilot study was conducted among 20 selected companies to ensure smooth sailing of the study at full scale. Top management and owners of the businesses were the primary target informants considering the nature of the information requested. In some cases, the primary targeted informants delegated to their appointees. Data collection stretched for eight weeks after initial mailing and remainder phone calls were made. In total, the number of returned instruments were 260, as some were not returned and some returned with limitations such as being incompletely answered. The sample spread is summarised in Table 1 below

Table 1: Sample spread

<table>
<thead>
<tr>
<th>Tourism Industry sub-sector</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation</td>
<td>4</td>
</tr>
<tr>
<td>Care HIRE</td>
<td>6</td>
</tr>
<tr>
<td>External Operators</td>
<td>5</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
</tr>
<tr>
<td>Hotel and Lodges</td>
<td>25</td>
</tr>
<tr>
<td>Tour Operators</td>
<td>9</td>
</tr>
<tr>
<td>Hunting and Safari</td>
<td>7</td>
</tr>
<tr>
<td>Holiday Resorts</td>
<td>6</td>
</tr>
<tr>
<td>Culture Sports and Entertainment</td>
<td>10</td>
</tr>
<tr>
<td>Travel Technology Company</td>
<td>6</td>
</tr>
<tr>
<td>Arts Craft and Curio services</td>
<td>6</td>
</tr>
<tr>
<td>Cruise Operators</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

The sample was drawn from eleven sub-sectors of the tourism and hospitality industry. The Hotels and Lodges commanded the majority share of the sample, followed by Cruise operators, Culture Sports and Entertainment and Tour operators.

Results and Discussions

Effects of nCovid 19 on the players

The study sought to quantify the negative effects brought by the pandemic on the performance indicators of the Tourism and hospitality players. Areas under measurement were nominal demand, which are the general inquiries about the tourism service, effective demand, which are the actual realized sales, revenue changes, raw material supply, working capital availability, operating costs and profit. The percentage bands (e.g. 0-20%) indicate the extent to which the Tourism businesses were negatively affected on an item under measurement. (A 0-20% fall means the business is less affected, a 80-100% fall means a business is heavily affected). An absolute 100% fall in revenue means a firm record zero revenue at that given period. The figure below is indicating the results of the survey with regard to the given measures.
As indicated by the above figure, Tourism and Hospitality players were adversely affected as demand for their services; revenue, profitability and profit were reduced by between 60% to 100%. Revenue, working capital and profit recorded the heaviest fall. It is interesting to note that the effective demand was heavily affected by the nCovid 19 whilst nominal demand (inquiries) remained comparatively high. Tourists continued to enquire about the services during the covid 19 period under study than they actually purchased the services. The desire to visit and enjoy remained alive despite the threat posed by the life-threatening pandemic. Comparison of the nominal demand and effective demand statistics bear testimony to this fact. Revenue and working capital were greatly affected as shown by majority of companies indicating 100% fall in these variables. Profitability fall heavily due to fall in revenue despite a less than proportionate increase in operating costs. Raw material supplies were least affected possibly due to local sourcing or due to raw materials become irrelevant during the lockdown period.

**Effects on workers and customers health in the Tourism sector**

Generally, for the period under study (February to September 2020), Zimbabwe recorded few nCovid 19 cases as compared to other countries in the world but regionally, Zimbabwe was the second highest after South Africa. The country had recorded 7 672 cases cumulatively as of 18 September 2020 according Zimbabwe Ministry of Health. The health impact of nCovid 19 in the sector was somewhat mild as depicted by the below figure.
Figure 3. Covid-19 positive cases in the Zimbabwean Tourism and Hospitality Sector

The study sought to establish the number of cases that were recorded in the Tourism and Hospitality industry over the nCovid 19 first peak period (February to September 2020) to quantify the direct impact of the virus on people’s health in the sector. The results indicated that 89% and 91% of the business recorded 0-20% infections on clients and workers respectively. 9% and 7% of the sampled businesses indicated 21-40% infections on clients and workers respectively. Impressively, zero companies indicated infections in the 61-100% category at their work places. The statistics sum up the effectiveness on the part of players and the government in containing the virus during the period under review.

Slack availability in the Tourism subsector

As discussed in the literature, the availability of slack resources affected an organization’s response to changes in the operating environment. As such, the study sought to ascertain the prevalence of slack resources in their various forms across the Tourism industries. The study shows that 55% of the respondents had available slack resources to mitigate the pandemic’s impact on business whilst only 45% indicated absence of slack resources. Further analysis show that diversification has a contribution to the availability of slack resources for the organisation. The results confirmed that 53% of the respondents who were in more than 2 subsectors, had available slack resources to fight covid-19 whilst 47% indicated that they didn’t have slack resources despite being in more than 2 subsectors of the Tourism and Hospitality industry.

Regression Summary Model

The study explores the correlation between organisation slack resources availability and the business performance indicators. The results given are as shown in the table below.
Table 2. Regression summary model

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.564a</td>
<td>.318</td>
<td>.234</td>
<td>.440</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Effect on profit, Effects of Covid 19 on nominal demand, Effect on operating costs, Effects of Covid 19 on working capital, Effects on raw material supply, Effects of Covid on effective demand, Effects of Covid on player revenue

A regression analysis was done between slack resources and performance indicators. The findings in the table above of the model summary give R Square value of .318 and Adjusted R Square is .234. The researcher used the Adjusted R Square since many scholars regard it as more accurate in sharing the predictive power on the dependent variable. As a percentage, performance indicators identified are explained 23.4% by slack resources. However, the remaining 75.6% is explained by other variables, which are outside the scope of this study.

Table 3: ANOVA table

<table>
<thead>
<tr>
<th>ANOVA*</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Regression</td>
<td>5.139</td>
<td>7</td>
<td>.734</td>
<td>3.799</td>
</tr>
<tr>
<td>Residual</td>
<td>11.015</td>
<td>249</td>
<td>.193</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16.154</td>
<td>260</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Availability of slack resources to fight Covid 19
b. Predictors: (Constant), Effect on profit, Effects of Covid 19 on nominal demand, Effect on operating costs, Effects of Covid 19 on working capital, Effects on raw material supply, Effects of Covid on effective demand, Effects of Covid on player revenue

An ANOVA analysis was done between slack resources and performance indicators (independent) at 95% confidence level, the F value = 3.799, P = 0.002 were obtained. Since the P value 0.002 is less than 0.05, therefore it is established that there is a linear relationship between slack resources and performance indicators. The presence of slack resources affects the resilience of a business to sustain its performance.

Strategic agility

Having ascertained the relationship between the slack resources and the performance variables, the research sought the relationship between slack availability and strategic agility. A slack resource versus strategic change cross-tabulation culminated in the below figure.
As shown by the figure, businesses with available slack resources mobilized them to change the business strategy in face of Covid 19. This helped them to maintain high performance in face of nCovid 19. 71% of the businesses with slack resources changed their strategies compared to 36% who changed strategy despite absence of slack resources. Explanatory notes indicated that, strategic change for slack possessing players was towards related, unrelated diversification, employment of non-contact technologies, creation of new departments, corporate ambidexterity and business model reconfiguration. Explanatory notes on the 36% who indicated strategic change despite slack resources absence showed bias towards retrenchment strategies such as laying off employees, disposing assets and closing some business units. The explanatory notes showed a sharp contrast in strategic change. Generally, availability of slack resources supported strategic change whilst its unavailability promoted strategic stagnation.

**Recommendations**

To mitigate against supply chain disruptions, players were recommended to consider reliance on the local value chains. Buttressing, this notion vertical integration is necessary in tourism for players to have control of raw material supplies as well as associated advantages such as quality control. For example local hotels can vertically integrate backwards to own viable market gardens to reduce fresh produce supply shocks, Based on the study outcome, companies in the Tourism and Hospitality are recommended to put systems in place to capture and store interests (nominal demand) during any crisis. Post crisis, players with inventory of interests can quickly revive demand through follow-ups on nominal demand.

Companies were recommended to create and maintain organisational slack resources to ameliorate unforeseen disruptions. Today’s business environment has many disruptions (unforeseen) therefore the need to preserve a reasonable threshold of organisational slack resources in form of both absorbed and unabsorbed slacks. The absorbed slack inform of stored capabilities, excess inventory, highly dynamic staff and unutilized capacities are important in crisis management. Unabsorbed slack resources such as excess liquidity are more redeployable to other uses during a crisis. For example, in this case, procurement of personal protective equipment and investment in non-contact technologies were the possible uses of unabsorbed slack. Tourism and Hospitality players who strategically employed their slack resources gained the trust of the few available customers and gained momentary competitive advantage enough to sail through the difficult period. Lessons from this pandemic must deposit some instinctive stimuli in the organisational memories.
to strategically accumulate organisational slack resources. Furthermore, corporate ambidexterity becomes paramount as a form of an absorbed slack building strategy.

With realization that international tourism was greatly affected by the pandemic, the government through its organs such as Zimbabwe Tourism Authority must increase the marketing of the brand Zimbabwe for the benefit of the cash strapped players in the sector. Relevant authorities must also consider statutory fees holidays and tax breaks as stimulus packages for the beleaguered Tourism and Hospitality players on top of access to affordable credit lines. Faced with disrupted international tourism market, with various source countries taking long to lift travel bans, local players must resort to local and regional markets as their relaunch pads. With general skepticism to travel due to the pandemic overhang and the menacing recurrence as witnessed in other countries, local Tourism and Hospitality players must employ reassuring and safety promising marketing communications to their target audience. Business model re-engineering, service design thinking and basic futurology are some of the requisite strategic moves. It must never be business as usual. Employment of necessary strategies and adjustments has become the new source of competitive advantage in Tourism and Hospitality industry at both company and national level.

**Future Studies**

Findings and conclusions of this study set a tonic for future researches in this area. Future researches must focus on determination of the most effective type of organisational slack resource to ameliorate a business environmental jolt such as a pandemic. This study merely looked at the prevalence of slack resources in a company and relation to agility. It is necessary to further study the optimum slack resources thresholds and their impact on the rapidity of resilience. Furthermore, concerning the tourism industry, the typology of corporate strategies employed by firms to manage thorough the crisis need further analysis together with the effects thereof. Surveys on the numbers of permanent business closures, worker retrenchments and corporate anorexia must be conducted to give a clear picture, post the pandemic.

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Literature Survey on KANBAN: Opportunities and Challenges

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Abstract—Every software development team thrives for success by managing the workflow and team coordination for timely product delivery with optimum customer satisfaction. Although not a new concept, agile is a requirement for future sustainability. It can be shown that businesses that fail to adopt some form of agile methods for product development also fail to meet customer and market demands and become greatly disadvantaged. Kanban and Scrum are two most popular and widely adopted development methodologies. This paper focuses on Kanban as an agile software development methodology. In addition to its challenges and opportunities associated with application of Kanban as a development methodology. Major benefits of using the Kanban as a software development methodology are lead time improvement for software delivery, software quality improvement, effective communication, improved coordination, greater consistency in product delivery, and improved customer satisfaction.

Index Terms—KANBAN, agile methods, workflow, efficiency, challenges

I. INTRODUCTION

Manufacturing is the cradle of KANBAN and this enduring approach has been applied by Toyota in 1953. Slowly it is becoming part of software development. Software development teams need to maintain high productivity to be competitive in the modern era of the fast-moving marketplace and cutthroat competition, which can only be achieved by managing the workflow during entire development process efficiently.

In traditional software development methodologies (waterfall model), it is quite not possible to achieve high level of productivity. Software development methodologies need to be customer-centric [2]. Also, those methodologies should be able to manage the changing requirements of the customer during development process.

According to a rough estimation, the agile software development method is used in around 85% of the leading software companies. As agile involves customer opinion with continual delivery of software products, thus customer satisfaction is acquired. KANBAN is an agile methodology that focuses on efficient teamwork and managing workflow effectively. KANBAN helps in achieving customer satisfaction, timely delivery of product, improved understanding and communication of team.

II. LITERATURE REVIEW

A qualitative case study was conducted in an organization to observe the service production of KANBAN been implemented in an IT organization with respect to change.
management in [1], and how the operational process of the organization are being changed by the KANBAN. The results of their research conclude that there is minimal resistance to change implementation in Volvo IT. The changes in implementation, are effectively handled by KANBAN, done by the team members.

Another study [2] focuses on the combination of Kanban and scrum, concludes that “Scrum ban” helps in process and productivity yielding beneficial economic outcomes.

Key ultimatums for Agile KANBAN method are i.e. Shortage of advance tracking technique, it’s hard to determine WIP limits due to lack of amp technique, and monitor project progress is not being provided by enough information and useful indicators [3].

In [4] the state of Baja California, using questionnaires for gathering data from different manufacturing companies, a model has been designed that depicts the influence of the planning phase and the advantages acquired in the enforcement of the KANBAN system.

The issues faced in the lean-agile software development environment are addressed in [5]. The study suggests that in order to sustain in this competitive world of software development, one must refrain from using old traditional methods. New and efficient methods should be adopted in order to deliver the software on time.

Kanban by itself does not assure success as it is a comparatively basic flow tool that needs to be supported by other practices [6].

A systematic literature review [7] examines the current trends of Kanban usage in software development along with identification of the benefits and challenges involved. The study suggests that Kanban should be used because it’s simple and it focuses on the workflow. Moreover, due to the usage of Kanban, customer satisfaction is achieved, and software quality is improved in addition to on-time delivery is done.

M. L. Mittal [8] examines the impact of lean methodology in software development projects and its status of implementation in software development projects. The results of the study conclude that the concepts of lean methods are evolving in SD projects. The problem faced in adopting lean method was more commonly found with customers, process and people.

Daryl J.Powell [9] aims to determine whether Kanban can be used for lean production in high mix, low volume environments. Strict limits are set for Work In Progress (WIP) after the
research by using two case studies on Toyotas manufacturing process using Con WIP principle. According to the research, by introducing an effective pull mechanism KANBAN board can be used to accelerate in high-mix, low-volume manufacturing environments based on available resource capacity rather than stock renewal. It also emphasizes daily standups.

Another study [10], focuses on the strengths and weaknesses of agile and traditional methodologies. The results of the study show that they’re not the one for all methods for software development. The combination of processes has helped many organizations to overcome the weaknesses of a single process, that’s why many organizations have adapted these combinations of processes.

Hamzah Alaidaros [11] observes the current tasks and examines the challenges which are in progress of Agile KANBAN method. Research reveals that Agile KANBAN technique lacks progress tracking mechanism; thus, this method needs to be combined with another method to be an effective method. The study suggests that a lot of changes must be made in Kanban methodologies so that it can be used more extensively.

III. Agile Methodology

Agile software development methodology revolves around the idea of iterative development, as shown in Fig. 1. In agile methodology, requirements and solutions are modified through teamwork of multi-functional and self-regulating teams. The essential aspect of Agile development is that it allows teams to deliver project more rapidly, with superior quality and certainty, and greater capacity to accept and respond to modification or variation.

Lean Software Development (LSD). Every single agile development framework ensures the successful release of the software product as a result of iterative planning, development, testing and integration

The key benefits of agile process framework are:

1) Customer Collaboration
2) Rapid Development.
3) Reduced risk of error
4) Quick response to changes
5) Customer satisfaction

A. Strengths and Weaknesses of different agile process frameworks:

The utmost admired agile methodologies are Kanban, Scrum, Feature Driven Development (FDD), Adaptive Software Development (ASD), eXtreme Programming (XP), Crystal, Dynamic Systems Development Method (DSDM) and Lean Software Development (LSD). Every single agile development framework ensures the successful release of the software product as a result of iterative planning, development, testing and integration

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<table>
<thead>
<tr>
<th>Process Framework</th>
<th>Strength</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrum</td>
<td>• Effective and efficient communication among team members.</td>
<td>• Employees lack knowledge of Scrum</td>
</tr>
<tr>
<td></td>
<td>• Continuous feedback from the customers.</td>
<td>• Scrum lacks engineering practices</td>
</tr>
<tr>
<td></td>
<td>• Produces quality product with customer satisfaction.</td>
<td>• Simple to understand but difficult to master</td>
</tr>
<tr>
<td></td>
<td>• Measuring the growth and productivity of the team and individual is</td>
<td>• Suitable for small projects</td>
</tr>
<tr>
<td></td>
<td>easier with daily Scrum meetings and sprint meetings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Quality product with customer satisfaction.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Can easily handle unclear and changing requirements.</td>
<td></td>
</tr>
<tr>
<td>Kanban</td>
<td>• Helps in managing production of a product Increase in communication</td>
<td>• Lack of details about its implementation</td>
</tr>
<tr>
<td></td>
<td>between the team and stake holders</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Positive impact on external quality of the system</td>
<td></td>
</tr>
<tr>
<td>Lean Software</td>
<td>• Eliminate waste</td>
<td>• Does not cover technical and managerial issues</td>
</tr>
<tr>
<td>Development</td>
<td>• Maximize value of the product</td>
<td>• Lack of details about its implementation</td>
</tr>
<tr>
<td>FDD</td>
<td>• Adaptive and incremental in nature</td>
<td>• Needs special training to write requirement/user stories</td>
</tr>
<tr>
<td></td>
<td>• Emphasis more on quality</td>
<td>• Less responsiveness to change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Need of experienced and trained staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Less appropriate for small scale projects</td>
</tr>
<tr>
<td>DSDM</td>
<td>• Users are highly involved in the development of the system so; they are</td>
<td>• Costly to implement, as it requires users and developers both to be trained within the development project.</td>
</tr>
<tr>
<td></td>
<td>more likely to get a grip on the software development project.</td>
<td>• It may not be suitable for small organizations or one-time projects</td>
</tr>
<tr>
<td></td>
<td>• In this model, basic functionality is delivered quickly, with more</td>
<td></td>
</tr>
<tr>
<td></td>
<td>functionality being delivered at frequent intervals</td>
<td></td>
</tr>
<tr>
<td>Crystal</td>
<td>• Effective communication among team members</td>
<td>• Lacks system validation practices</td>
</tr>
<tr>
<td></td>
<td>• Projects can be clearly classified using Crystal methods</td>
<td></td>
</tr>
<tr>
<td>Extreme Programming</td>
<td>• Pair programming and continuous integration improves productivity</td>
<td>• Lack of documentation</td>
</tr>
<tr>
<td></td>
<td>• Works well with simple and small-scale projects</td>
<td>• Poor architectural structure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Less focus on design</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pair programming requires mutual understanding and common skillset between</td>
</tr>
<tr>
<td></td>
<td></td>
<td>two programmers</td>
</tr>
<tr>
<td>Test Driven</td>
<td>• Writes test cases and test code first using the requirements</td>
<td>• Sometimes very time consuming due to repeated test failures</td>
</tr>
<tr>
<td>Development</td>
<td>• Writes Lean code, removes duplicates</td>
<td>• Specific knowledge and skill set required</td>
</tr>
<tr>
<td>Adaptive Software</td>
<td>• Focuses on collaboration and learning as a technique to build complex</td>
<td>• Demands extensive user involvement, which can be difficult to facilitate.</td>
</tr>
<tr>
<td>Development</td>
<td>systems.</td>
<td>• Integrates testing into every stage, which can add to a project's costs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Emphasis on rapid iterating and continuous feedback can lead to scope creep.</td>
</tr>
</tbody>
</table>
As shown in table 1, Scrum helps in having continuous feedback from the customer. It helps in effective communication between the team. But the usage of Scrum as development methodology is often limited due to lack of knowledge among developers. It does not apply to large projects. It is simple to understand yet challenging to master at it. Using Scrum, the customer is highly satisfied, as daily Scrum meetings are done with the customer which increases the quality of product.

Lean software development approach does not consider technical issues. It helps in eliminating the waste by focusing on only what is needed which maximizes the product value.

To implement the Feature Driven Development approach, one needs to acquire special training in writing user stories. Also, it requires an experienced and trained team to handle the requirements. It is much adaptive in nature and focuses mainly on quality of product.

Dynamic System Development Method is highly expensive, as it requires a trained and experienced team. It is suitable for large organizations only. In DSDM, users are involved in each step of software development. Using this approach, the basic functionality of the project is delivered earlier than rest of the modules which get delivered in intervals.

The Crystal Family lacks the validation approach. It helps in classifying the projects. The team members communicate with each other more effectively.

In eXtreme Programming, there is no need for documentation, as pair programming helps more in getting along with the understanding of the projects. It focuses less on design. But continuous integration of modules improves the productivity. Test Driven Development approach can be time-consuming because of continuous test failures. Test cases are generated first using the requirements. It requires definite knowledge and set of skills to implement it.

In Adaptive Software Development, user involvement is required at an extensive level, which can be a challenging task. It focuses on immediate iteration and constant feedback from the user/customer. As it involves testing at every stage, the cost of the product can increase.

IV. KANBAN

Kanban is one of the most popular agile approaches that is used by practitioners in software development. The idea of Kanban is to deliver the software product continuously and incrementally without over burdening the team. The development team keeps a track of the work progress by using a Kanban board.

A. Kanban Board

The Kanban board comprises of the labelled columns which help in keeping the track of the progress of work. Each column has sticky notes that represent the task on which the team must work.

Kanban handles the Work In Progress (WIP) limit, so each column has a limit of tasks indicated at the top of each column. That abstinats the team from overburdening themselves.
As shown in Fig. 2., it is the simplified form of Kanban board in which the columns are labelled as ‘ToDo’, ‘Doing’, and ‘Done’. When any task newly arrives, it is categorized in the ‘ToDo’ column. Those tasks which are under process and the team is working upon them, are catalogued in ‘Doing’ column. ‘Done’ column comprises of those tasks which are completed.

In Fig. 3., the Kanban columns are labelled as ‘Pending’, ‘Analysis’, ‘Development’, ‘Test’, and ‘Deploy’. The analysis and development columns are further divided into ‘Doing’ and ‘Done’ columns. The limit of tasks that each column can have, is specified at the top of the respective column. At most 6 tasks can be placed in the ‘Pending’ column. There can only be 3 tasks in the ‘Analysis’ column. For ‘Development’, ‘Test’ and ‘Deploy’, the WIP limit is 5, 3 and 5 respectively.

The tasks that newly arrive are classified into the pending column. Then, if there is a vacancy for a new task, only then the new tasks are pulled by the system and can be categorized as ‘Doing’ in the analysis column. Once the analysis is completed, that task is labelled as ‘Done’ by analyst.

That task is the pulled by the system into the next phase that is the development phase. Those tasks which are under process, are labelled as ‘Doing’ and those which are completed,
are labelled as ‘Done’. Then the next phases are testing and deployment phases. There can only be at most 3 modules for testing. And deployment can have 5 modules.

B. Motivation to use Kanban

There are several factors that motivates a practitioner to use Kanban approach for their software product development, some are enlisted below:

1) Simplicity
2) Visualize workflow
3) Focusses on workflow
4) Customer satisfaction
5) Improved Software quality
6) No massive documentation
7) Adaptive to changes in requirements
8) Continuous flow of work
9) WIP limit

Kanban is the most preferable agile process work due to its simplicity. It uses Kanban board on which the work progress can be visualized by categorizing it into ‘to do’, ‘in progress’, ‘testing’ and ‘done’. It makes it easier for the team to keep track of processes completed or in progress. Also, it shows the roles and responsibilities of each team member. Which makes it easier for the project manager to keep track of work progress of each module.

Another motivation to use Kanban is that it limits the work in progress. It sets the limit of work to be done in one each status of the workflow. It is called a push and pull system. A new process is pulled by the system if there is vacancy/ space for new work. Otherwise, it is not pushed into the system unless the existing process is completed.

As it involves team cohesion and collaboration, so it is guaranteed to have improved software quality and customer satisfaction.

Kanban is highly adaptive to changes in requirements. The changes are added to the process as they are needed, and the team do not have to wait unlike in scrum.

Kanban focuses on the development of those items which are needed and requested. Due to this approach, the workflow is balanced and remains maintained which ensures the constant releases of work items to the customer.

Kanban is preferred because it uses shorter feedback loops from the customer. And those feedbacks help to remove bugs and errors at an early stage and the developer doesn’t require to have a hard time debugging. Also, customer satisfaction is acquired.

C. Benefits of Kanban

Along with several other benefits of Kanban, some of them are listed below:

1) Customer Satisfaction
2) Improved software quality
3) Improved lead time delivery
4) Earlier feedback
5) Reduction in customer error reporting
6) Improved communication between stakeholders
7) Increased developer motivation
8) Bugs fixed more quickly
9) Better understanding of project
10) Reduced cycle time
11) Ensured team training
12) Improve transparency
13) Strategic alignment
14) Changes are added as needed

By using the Kanban process framework, one can achieve many benefits for their software product.

Top of all, customer satisfaction is acquired because of improved software quality and continuous collaboration with the customer for testing. Bugs and errors are detected at an earlier stage, that reduces the time to market for the software product. Communication and collaboration between the customer and team are improved. It increases the predictability in the delivery of the final products and more precise estimate of the work [6].

D. Challenges in Kanban

The most challenging aspect of using Kanban is that it cannot be used alone, and it requires supporting approaches like scrum. So, the combination of two is called “Scrumban”. Another challenging thing about Kanban is that the team can overload/overcomplicate the Kanban board. They need to keep it simple for rest of the team to understand it easily, but some member can learn “new tricks” and apply those on Kanban board which hides the important information.

It is hard to manage WIP, as there is no time frame for any process. Only the progress is labelled as ‘in progress’, ‘to do’, ‘completed’. Time frame is not defined, so we don’t know how much time it will take for a task to be completed.

Getting the whole team to agree on one point is quite a difficult task. So, changing the organizational culture is quite a challenging thing when you are using Kanban.

Sometimes collaboration and communication issues occur which create a really challenging environment to work in.

E. When to use Kanban

Kanban is recommended if any of the following conditions occur

1) When it is required to include stories or alter sprints on the fly
2) When iterations are not required.
3) When there is no need to estimate.
4) When you need more control over the process and the capability to deliver the product at any time.
5) When your focus is on continuous improvement.
6) When your team is not adaptive to extreme changes
7) When you want to enhance delivery flow
8) When you want your system to be easy to grasp

V. COMBINATION OF SCRUM AND KANBAN

It is challenging to implement Kanban as the only development methodology, so it is used in combination with other
process frameworks like scrum, which is called Scrumban. Fig. 4. depicts the methodology of Scrum. Scrumban comprises of the finest suitable policies from Scrum and Kanban. It contains the best features from Scrum and Kanban. Those are enlisted below:

A. *Features of Scrum:*
   1) Iterations
   2) Stand-ups
   3) Prioritization
   4) Decide length of sprint

B. *Features of Kanban:*
   1) WIP limit
   2) Pull system
   3) Continuous flow of work
   4) Short lead times

In Scrumban, there is no need for a precise number of members in a team. Also, they do not require to specify their roles. Scrumban uses acceptably rigorous rules and grants a possibility for a controlled Kanban process to some extent. The work cycles do not exceed more than 2 weeks. Daily stand-up meetings are carried out.

C. *Benefits of Scrumban:*
The key benefits of using Scrumban are as follows:
   1) The quality of product is increased as there is 25-70% reduction in errors and defects.
   2) The productivity is increased by 20-45%.
   3) Time to market is increased by 30-70%.
   4) Employees are more motivated and happier.
   5) Waste is minimized

D. *When to use Scrumban:*
Scrumban can be used when following conditions occur:
   1) When you want flexibility of workflow-based approach along with scrum structure.
   2) When you want to switch between scrum and Kanban

VI. **Kanban Analysis**

F. *Comparison between Kanban and other Agile Methods:*

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Table 2. Comparison of Kanban with other Agile Methods [12]

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Kanban</th>
<th>Scrum</th>
<th>Extreme programming</th>
<th>FDD</th>
<th>Crystal Family</th>
<th>DSDM</th>
<th>Lean software development</th>
<th>ASD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model-based</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Number of team members</td>
<td>Not Specified</td>
<td>5-9</td>
<td>2-10</td>
<td>4-20</td>
<td>All members</td>
<td>2-10</td>
<td>Not specified</td>
<td>Moderate</td>
</tr>
<tr>
<td>Scope of project</td>
<td>Entire</td>
<td>Entire</td>
<td>Narrow</td>
<td>Broad</td>
<td>Entire</td>
<td>Entire</td>
<td>Entire</td>
<td>Narrow</td>
</tr>
<tr>
<td>Daily meeting</td>
<td>Defined</td>
<td>Defined</td>
<td>Defined</td>
<td>Not defined</td>
<td>Not defined</td>
<td>Not defined</td>
<td>Not defined</td>
<td>Defined</td>
</tr>
<tr>
<td>Documentation</td>
<td>Not defined</td>
<td>Simple</td>
<td>Simple</td>
<td>Essential</td>
<td>Essential</td>
<td>Exists</td>
<td>Not Defined</td>
<td>Simple</td>
</tr>
<tr>
<td>Risk Mitigation</td>
<td>Hight Risk</td>
<td>Not defined</td>
<td>Defined</td>
<td>Not defined</td>
<td>Defined</td>
<td>Defined</td>
<td>Not defined</td>
<td>Defined</td>
</tr>
<tr>
<td>Medium Risk</td>
<td>Defined</td>
<td>Not defined</td>
<td>Defined</td>
<td>Defined</td>
<td>Not defined</td>
<td>Defined</td>
<td>Defined</td>
<td>Not defined</td>
</tr>
<tr>
<td>Process centric</td>
<td>Defined</td>
<td>Not defined</td>
<td>Not defined</td>
<td>Defined</td>
<td>Not defined</td>
<td>Defined</td>
<td>Defined</td>
<td>Not defined</td>
</tr>
<tr>
<td>Virtual team support</td>
<td>Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Defined</td>
</tr>
<tr>
<td>Face to face meetings</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
</tr>
<tr>
<td>Iteration length (week)</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>Project specific</td>
<td>Not Specified</td>
<td>Not Specified</td>
<td>4-8</td>
</tr>
<tr>
<td>People centric</td>
<td>Not Defined</td>
<td>Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Defined</td>
</tr>
<tr>
<td>Roles and responsibilities</td>
<td>Defined</td>
<td>Defined</td>
<td>Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
</tr>
<tr>
<td>Information sharing (through document)</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Defined</td>
<td>Not Defined</td>
<td>Not Defined</td>
</tr>
</tbody>
</table>
As shown in table 2, Kanban is a lean method to organize and ameliorate work across human systems. This technique focuses on how to manage work by stabilizing requirements with available capacity, and by enhancing the handling of system-level. The number of team members is not specified with which they work. The entire team is responsible for the project’s success.

In Kanban, daily meetings are prescheduled and when they’re having their regular meetups so, documentation is not required. Kanban is a non-riotous evolutionary change management system this shows that the process is improved in small steps. By implementing many minor changes, the risk to the overall system is reduced.

Kanban is a process-centric methodology which includes the support of the virtual team as it is needed to ensure the teams’ success.

Face to face meetings are not defined as people are working on their tasks. You may have a prioritization process and not need to hold discussions on it; you may find that you can do perfectly well with a weekly team meeting instead of a daily one. Only a week is given for the iteration. Roles and responsibilities are defined in it. Information sharing through documentation is not pre-defined in Kanban.

According to our analysis, though Kanban is beneficial due to its simplicity and other facts, but Kanban cannot be used alone. It must be used in combination with other methodology. Research on Kanban in Software engineering has been a quite popular topic among researchers during year 2018.

Fig.6 depicts the number of publications in IEEE XPLOR each year since 2016 to 2019. In year 2016, total of 17 papers have been published in IEEE XPLOR regarding Kanban. Whereas in 2017, 19 papers were published. Kanban has been a trending topic in year 2018 as total 22 papers have been published in IEEE XPLOR.

In ACM Digital Library, total 216 papers have been published regarding Kanban during years 2016 to 2019. The graph in Fig. 7 depicts the number of papers published each year since 2016. During year 2016, total 41 papers were published in ACM Digital library that were related to Kanban. Whereas, the count increased next year in 2017 and total 53 papers were published. Kanban has been a hot topic in 2018 as total 73 papers were published in ACM Digital Library during 2018. This rapid increase in publications, decreased abruptly and reached to 49 in year 2019.

VII. CONCLUSION

The aim of this paper was to focus on Kanban as an agile software development methodology. Along with challenges and opportunities associated with applications of Kanban as development methodology. The key advantage of applying the Kanban as software development methodology are lead time improvement for software delivery, software quality improvement, effective communication, improved coordination, greater consistency in product delivery, and improved customer satisfaction. Though, the advantages of Kanban identified in this paper are more than the challenges, Kanban alone does not assure success as it is comparatively a basic flow tool that needs a support of other process frameworks. The combination of Scrum and Kanban is found to be beneficial as it increases the quality of product as there is 25-70

REFERENCES


Fig. 5. IEEE Xplore Publications on Kanban since 2016 to 2019

As Fig. 5 shows that total 70 publications regarding Kanban have been published in IEEE XPLOR since 2016 till 2019. Out which those 70 publications, 65 are published in conferences, 3 in magazines, 1 in Book and Journal each.

Fig. 6. IEEE Xplore Publications on Kanban Each Year


Study and Analysis of Atomic Spectra

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Abstract- When we look at objects giving off light (or reflecting light) we find three types of spectra. They are produced in different ways, and can actually tell us about the physical properties of the materials producing the spectra. These spectra are known as “a continuous spectrum” (or continuum emission), “an emission line spectrum” and “an absorption line spectrum”. Here, in this project we have tried to analyze all these spectra obtained from common light sources and KMnO₄. All the spectra were obtained with the help of a diffraction grating & spectrometer. Later, the spectra corresponding to different wavelengths and energy levels were observed. The electronic transitions and material involved in the formation of spectra were found out. Also, the wavelength of the light emitted, absorbed by a specific light source or molecule was determined along with the vibrational energy level of phosphor coating and energy lost in collision in case of a CFL.

Index Terms- Continuous spectrum, Energy levels, Absorption spectrum, Emission spectrum.

I. INTRODUCTION

We see very differently than we hear. With sound, we are able to pick out many different frequencies, i.e. different pitches. When different lights comes from different sources instead of seeing different colors we see all together as one color, which is made up of many different wavelengths of light. The electromagnetic spectrum, shown in Fig.1, shows a range of wavelengths, from gamma rays at 10⁻¹⁴ m to AM radio waves at 10⁴ m. In this project, we considered the narrow band of wavelengths, ~ 400 – 750 nm, that make up visible light into consideration. Visible light primarily derives from artificial sources, such as Fluorescent, Incandescent and LED lights. By observing these common light sources along with KMnO₄ molecule, three different spectra were observed.

![Electromagnetic Spectrum](image)

Fig 1: The electromagnetic spectrum with the visible light region blown up.

II. THEORY

In this project, we have explored light acting as a particle, known as photon. In the quantum model of the atom, electrons exist only in specific energy states. The photon ejected from an atom while electrons come down from higher energy state to lower energy state that is the difference between those states, so only certain amount of energies are emitted. The elements of Periodic table is where every element is uniquely identified by the number of protons in its nucleus. Quantum mechanics explains the energy states of the electrons in an atom. Each element in the periodic table has a specific electron energy levels as shown in Fig.2 (a), so for a given element only photons of specific energies can be emitted. Therefore, when we are measuring the emission spectrum of an element, only specific wavelengths of light are allowed and the pattern produced is unique for that substance. Atoms and molecules
may change states when they absorb specific amounts of energy. When electrons are arranged in atomic orbitals they produced a pattern known as atomic states. An electron may absorb some certain amount of energy that is the difference between two orbitals so that to get and jump to that state. Molecular states consists of molecule's modes of vibration as well as rotation. Likely to the atomic orbitals these vibrational and rotational modes are also quantized, and by absorbing photon they may be excited. In both the cases, the excited states do not persist: after some time the atoms regain its original position that is the lower energy state. Generally in case of atoms the excited electron come back to lower state by emitting a photon. Similarly in molecules, the vibrational or rotational mode decays a photon. In the process of decays the photon direction may differ from original one. Most of these photon deviates ~45 degrees from the previous one. This clearly indicates that in case of light spectrum the gaps shows as that part of wavelength of light is absorbed. These gaps appear as black lines in an image of the spectrum known as absorption line spectrum.

![Absorption & Emission Spectra formation](image)

**Fig 2(a): Absorption & Emission Spectra formation (Quantum Phenomenon)**

![Formation of all the 3 types of spectra](image)

**Fig 2(b): Formation of all the 3 types of spectra with the help of prism.**

### III. METHODS AND MATERIALS

CFL bulb, Incandescent bulb, LED bulb, KMnO₄ solution, spectrometer, prism, grating plate, optical levelling apparatus are required. Adjust the spectrometer and perform optical levelling of the spectrometer. After proper adjustments of the spectrometer, place the prism on the turntable and perform Schuster’s method for setting up the spectrometer for parallel rays. Set the minimum deviation on the green line from the spectrum and focus the telescope and the collimator so as to get a fine image of the spectrum. Now replace the prism by a Diffraction grating (known grating element). Rotate the telescope in such a way that the slit can be seen directly through it. Get the θ value of this position. Add or subtract 90° from this θ value and rotate the telescope by that value. The telescope should be perpendicular to the plane of the collimator. Now rotate the turn table with

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the Diffraction grating mounted until the reflected image from the grating falls on the telescope cross wire. Place the cross wire at center to the reflected slit image. Measure the θ for this position. Add or subtract 45° from this position and rotate the prism table in such a way that the grating is parallel to the face of the collimator as it is rotated by 45°. Unclamp the telescope. The spectrometer is now set to take readings. Take readings for all dominant wavelengths of the spectrum. Use the formula \( \lambda = \sin \theta / N \) to get the wavelengths of spectral lines. Calculate energy of these lines using \( E = hc/\lambda \). The adjustments of the spectrometer and the diffraction grating (Experimental setup) is shown in Fig 3 (a, b, c).

![Image of Optical setup of the spectrometer with light source.](Fig 3(a): Optical setup of the spectrometer with the light source.)

![Image of Setup of the telescope with the grating for parallel rays.](Fig 3(b): Setup of the telescope with the grating for parallel rays.)

![Image of Observing the spectra and determination of θ.](Fig 3(c): Observing the spectra and determination of θ.)

**IV. OBSERVATION AND DATA**

No. of lines on grating = 15,000/inch, Grating element = \( N = 15,000/2.54 = 5905.51 \), therefore, \( 1/N = 1.693 \times 10^{-6} \) Least count of spectrometer = 1’.

*Incandescent Lamp:*

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We observed a continuous spectrum. The data obtained from the Incandescent Lamp spectra is tabulated below:

Direct Reading: Window X: 126°36′ & Window Y: 306°35′.

Table 1: Data obtained from Incandescent Lamp

<table>
<thead>
<tr>
<th>color Band</th>
<th>X</th>
<th>Y</th>
<th>Θ₁</th>
<th>Θ₂</th>
<th>Mean Θ</th>
<th>λ=sinθ/N (nm)</th>
<th>E=hc/ λ (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start (Violet)</td>
<td>141°6′</td>
<td>321°5′</td>
<td>14°15′</td>
<td>14°30′</td>
<td>14°23′</td>
<td>420.55</td>
<td>2.94</td>
</tr>
<tr>
<td>End (Red)</td>
<td>150°42′</td>
<td>330°39′</td>
<td>24°6′</td>
<td>24°4′</td>
<td>24°5′</td>
<td>693.1</td>
<td>1.78</td>
</tr>
</tbody>
</table>

CFL Lamp:

In this case we observed an emission line spectrum. The data obtained from the CFL Lamp spectra is tabulated below:

Direct Reading: Window X: 126°36′ & Window Y: 306°35′.

Table 2: Data obtained from CFL Lamp

<table>
<thead>
<tr>
<th>color</th>
<th>X</th>
<th>Y</th>
<th>Θ₁</th>
<th>Θ₂</th>
<th>Mean Θ</th>
<th>λ=sinθ/N (nm)</th>
<th>E=hc/ λ (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>149°50′</td>
<td>329°40′</td>
<td>23°14′</td>
<td>23°5′</td>
<td>23°10′</td>
<td>666.03</td>
<td>1.86</td>
</tr>
<tr>
<td>Orange 1</td>
<td>147°57′</td>
<td>327°53′</td>
<td>21°21′</td>
<td>21°18′</td>
<td>21°20′</td>
<td>615.90</td>
<td>2.01</td>
</tr>
<tr>
<td>Orange 2</td>
<td>147°27′</td>
<td>327°32′</td>
<td>20°51′</td>
<td>20°57′</td>
<td>20°54′</td>
<td>603.95</td>
<td>2.05</td>
</tr>
<tr>
<td>Yellow 1</td>
<td>146°46′</td>
<td>326°53′</td>
<td>20°10′</td>
<td>20°18′</td>
<td>20°14′</td>
<td>585.51</td>
<td>2.11</td>
</tr>
<tr>
<td>Yellow 2</td>
<td>146°22′</td>
<td>326°47′</td>
<td>19°46′</td>
<td>19°54′</td>
<td>19°50′</td>
<td>574.40</td>
<td>2.15</td>
</tr>
<tr>
<td>Green 1</td>
<td>145°36′</td>
<td>325°39′</td>
<td>19°0’</td>
<td>19°4’</td>
<td>19°2’</td>
<td>552.11</td>
<td>2.24</td>
</tr>
<tr>
<td>Green 2</td>
<td>144°7’</td>
<td>324°14’</td>
<td>17°31’</td>
<td>17°39’</td>
<td>17°35’</td>
<td>511.44</td>
<td>2.42</td>
</tr>
<tr>
<td>Blue</td>
<td>143°17′</td>
<td>323°18′</td>
<td>16°41’</td>
<td>16°43’</td>
<td>16°42’</td>
<td>486.50</td>
<td>2.54</td>
</tr>
<tr>
<td>Blue Green</td>
<td>142°49′</td>
<td>322°47’</td>
<td>16°13’</td>
<td>16°12’</td>
<td>16°13’</td>
<td>472.8</td>
<td>2.62</td>
</tr>
<tr>
<td>Violet</td>
<td>141°35’</td>
<td>321°42′</td>
<td>14°59’</td>
<td>15°7’</td>
<td>15°3’</td>
<td>439.6</td>
<td>2.82</td>
</tr>
</tbody>
</table>

LED Lamp:

Here, we observed a continuous spectrum. The data obtained from the LED Lamp spectra is tabulated below: Direct Reading: Window X: 126°36′ & Window Y: 306°35′.
Table 3: Data obtained from LED Lamp.

<table>
<thead>
<tr>
<th>color Band</th>
<th>X</th>
<th>Y</th>
<th>Θ₁</th>
<th>Θ₂</th>
<th>Mean Θ</th>
<th>λ=sinθ/N (nm)</th>
<th>E=hc/λ (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start (Violet)</td>
<td>141°16′</td>
<td>321°8’</td>
<td>14°40’</td>
<td>14°33’</td>
<td>14°36’</td>
<td>426.75</td>
<td>2.90</td>
</tr>
<tr>
<td>End (Red)</td>
<td>150°20′</td>
<td>330°16’</td>
<td>23°44’</td>
<td>23°41’</td>
<td>23°42’</td>
<td>680.49</td>
<td>1.82</td>
</tr>
</tbody>
</table>

**KMnO₄:**

Case 1: Here, we observed an absorption line spectrum by using LED as light source. The data obtained from the spectra of KMnO₄ is tabulated below: Direct Reading: Window X: 138°30’ & Window Y: 318°29’.

Table 4(a): Data obtained from KMnO₄ using LED Light

<table>
<thead>
<tr>
<th>Dark Band</th>
<th>X</th>
<th>Y</th>
<th>Θ₁</th>
<th>Θ₂</th>
<th>Mean Θ</th>
<th>λ=sinθ/N (nm)</th>
<th>E=hc/λ (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>155°5’</td>
<td>335°5’</td>
<td>16°35’</td>
<td>16°36’</td>
<td>16°36’</td>
<td>483.67</td>
<td>2.56</td>
</tr>
<tr>
<td>End</td>
<td>159°42’</td>
<td>339°45’</td>
<td>21°12’</td>
<td>21°16’</td>
<td>21°14’</td>
<td>613.14</td>
<td>2.02</td>
</tr>
</tbody>
</table>

Case 2: We observed an emission line spectrum by using CFL as light source. The data obtained from the spectra of KMnO₄ is tabulated below: Direct Reading: Window X: 138°30’ & Window Y: 318°29’.

Table 4(b): Data obtained from KMnO₄ using CFL Light

<table>
<thead>
<tr>
<th>color</th>
<th>X</th>
<th>Y</th>
<th>Θ₁</th>
<th>Θ₂</th>
<th>Mean Θ</th>
<th>λ=sinθ/N (nm)</th>
<th>E=hc/λ (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>159°19’</td>
<td>339°6’</td>
<td>40°49’</td>
<td>20°37’</td>
<td>20°43’</td>
<td>598.89</td>
<td>2.07</td>
</tr>
<tr>
<td>Blue</td>
<td>154°3’</td>
<td>334°18’</td>
<td>15°33’</td>
<td>15°49’</td>
<td>15°41’</td>
<td>457.56</td>
<td>2.71</td>
</tr>
</tbody>
</table>

V. DATA ANALYSIS, RESULT AND DISCUSSION

**Incandescent Lamp:** When electric current is passed through a tungsten filament wire it gets heated and dose glows/incandesces which results in producing light. The composition of an incandescent lamp is shown in Fig 4.
As observed, the hot filament produces is a “continuous” spectrum, because all the wavelengths of light are present (the spectrum has no breaks). The filament acts as a blackbody, emitting all possible wavelengths of light similar to the sun (Planck’s Law). When filament burns, chemical reaction called combustion in which large amount of energy is released. Some part of energy is heat, while other is light. Substances when heated emits light because the atoms present gains energy and gets excited, which results in spectrum formation. Heating makes the atom unstable, after sometime they give off the energy as photon and become stable. Heated electrons in the continuous energy bands of tungsten becomes excited and transition takes place to lower energy state. As mercury vapor lamp these spectrums are continuous. As it considered spectrum in visible range but still have energies near Infrared region.

From the obtained spectra, it was quite evident that the wavelengths in the range from 420.55 nm to 693.1 nm were emitted by the incandescent lamp. However, it is important to note that the light bulb emits a lot of infrared radiation which is not visible to the human-eye. These infrared radiations lead to the generation of heat along with light in case of an incandescent lamp.

**CFL Lamp:** The light produced from CFL is different than that of Incandescent Lamp. In a CFL, an electric current is passes through a argon and mercury vapor contain tube. This creates invisible ultraviolet light that excites a fluorescent coating (called phosphor) inside the tube, which then emits visible light. The composition of CFL lamp is shown in Fig 5.
Molecule in excited electronic state can lose energy and return to its ground state in various ways. The molecule may simply emit a photon of the same frequency as that of absorbed photon, thereby returning to the ground state in a single step. There is one more possibility that the molecule gives up some of its vibrational energy in collisions, so the downward radioactive transition originates from a lower level in the upper electronic state. This phenomena is known as Fluorescence. Therefore the fluorescence radiation is of lower frequency than that of the absorbed radiation. This is the working principle of CFL lamp. From the observations, it was observed that only certain photons having discrete energy levels were visible which produces an emission line spectrum. The following results is obtained by evaluating the difference in energy levels:

Table 5: Energy level data of CFL Light

<table>
<thead>
<tr>
<th>Energy levels</th>
<th>Energy difference (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red – Orange 2</td>
<td>0.19</td>
</tr>
<tr>
<td>Orange 2 – Yellow 2</td>
<td>0.1</td>
</tr>
<tr>
<td>Yellow 2 – Green 2</td>
<td>0.27</td>
</tr>
<tr>
<td>Green 2 – Blue</td>
<td>0.12</td>
</tr>
<tr>
<td>Blue - Violet</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Energy conservation law is taken into consideration which explains the following equations:

\[ \text{Energy (UV)} = \text{Energy (Color)} + \text{Energy (Collisions with phosphor)} \]

We know, \( \lambda \) (UV) = 254 nm, Similarly, \( E \) (UV) = \( \frac{hc}{\lambda} = 4.88 \text{ eV} \), the equation of energy lost in collision for each photon can be given by:

\[ \text{Energy (Collisions with phosphor)} = \text{Energy (UV)} - \text{Energy (color)} \]

From the above equation the following table (Table 6) is tabulated:

Table 6: Energy loss of different photons

<table>
<thead>
<tr>
<th>Color</th>
<th>Energy (color) (eV)</th>
<th>Energy (Collisions with Phosphor) (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>1.86</td>
<td>3.02</td>
</tr>
<tr>
<td>Orange 1</td>
<td>2.01</td>
<td>2.87</td>
</tr>
<tr>
<td>Orange 2</td>
<td>2.05</td>
<td>2.83</td>
</tr>
<tr>
<td>Yellow 1</td>
<td>2.11</td>
<td>2.77</td>
</tr>
<tr>
<td>Yellow 2</td>
<td>2.15</td>
<td>2.73</td>
</tr>
<tr>
<td>Green 1</td>
<td>2.24</td>
<td>2.64</td>
</tr>
<tr>
<td>Green 2</td>
<td>2.42</td>
<td>2.46</td>
</tr>
<tr>
<td>Blue</td>
<td>2.54</td>
<td>2.34</td>
</tr>
<tr>
<td></td>
<td>Blue Green</td>
<td>Violet</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>Energy</td>
<td>2.62</td>
<td>2.82</td>
</tr>
<tr>
<td>Value</td>
<td>2.26</td>
<td>2.06</td>
</tr>
</tbody>
</table>

From Table 6 the **average energy lost during collision** was found = 2.598 eV

Hence, obtained spectra from CFL as a light source, photons were emitted which leads to the formation of emission spectra and the energy levels and wavelengths were calculated with the energy which is lost when the CFL glows. Energy is lost due to collisions taking place between phosphor material and the charged ions.

**LED Lamp:** The spectrum is produced either by a single Light-emitting-diode, or combinations of phosphors and LED, or several different LEDs. The formation of continuous spectrum is explained by band theory. The general mechanism of LED is explained in Fig 6. LED is basically a sandwich of semiconductors. Semiconductors can either be natural elements (such as Si or Ge) or carefully engineered semiconductors. The sandwich of the semiconductor creates a flow of electrons, which leads to the production of photons having certain wavelength, which depends on the electronic structure of the semiconductors. In the LED/phosphor case, usually blue LED gives off light which is then absorbed by the phosphors to produce the other colors of the spectrum. In multiple LED case, there are different types of LED which when combine, produces all the colors of the spectrum.

![Components of LED Lamp](image)

The material used in LEDs is basically **aluminum-gallium-arsenide** (AlGaAs) as shown in Fig 6. In its original state the atoms are held tightly. The conduction of electricity becomes impossible due to lack of free electrons. The balance of material is disturbed by introducing some extra amount of atoms called doping. These doping creates some extra electrons or sometimes sucks the available electrons and creates holes which leads to create P-type semiconductors. Due to the property of semiconductor, current will not travel in opposite directions in the respective cases. This explains that the intensity of light emitted from source (LED) will depend on the energy level of emitted photons which in turn will depend on the energy released by the electrons. To make an electron shift from lower to higher orbits, energy level needs to be lifted. Conversely, when the electrons fall from the higher to lower orbits, energy is released. The above phenomena are well exploited in LEDs. In P-type doping, electrons fall from higher to lower orbitals releasing energy in form of photons that is light. The far the orbitals, the greater the intensity of emitted light.

From the obtained spectra, it was clear that the wavelengths in the range from **426.75 nm** to **680.49 nm** were emitted. LED bulbs also have higher efficiency as compared to an incandescent bulb due to its ability to provide light without generation of heat and also as it does not contain any toxic substances.
**KMnO₄:**

Case 1: An absorption spectrum of KMnO₄ was obtained using LED source. It was noted that a band of light was absent in the spectrum suggesting that the photons of that band were completely absorbed by the KMnO₄ solution. An absorption spectrum shows how much light is absorbed for a range of wavelengths.

It was determined that solutions of analyte may absorb light of different wavelengths. When we put something in front of our eyes that leads to absorption of color from the incoming light and show us the same. For instance, the analyte (potassium permanganate or KMnO₄) absorbs light in the green region of the visible spectrum as shown in Fig 7, allowing red and blue light pass through as shown in Fig 8. The mixture of blue and red is perceived by the eye as the typical purple color of KMnO₄.

![Fig 7: Absorption spectra of KMnO₄ solution.](image)

Hence, it was noted that the wavelengths in the range from **483.67 nm** to **613.14 nm** which predominantly involves green color were completely absorbed by the solution and rest all photons were emitted.

Case 2: An emission spectrum of KMnO₄ was obtained with the help of CFL source. It was noted that certain photons having specific energies were emitted by the KMnO₄ solution. The emitted line spectrum observed is shown in the Fig 8 which shows the blue and red photon of specific energies **2.07 eV** and **2.71 eV** respectively.

![Fig 8: Emission spectra of KMnO₄ solution.](image)

VI. CONCLUSION

A comparative study of the three different types of spectrums obtained from common light sources and KMnO₄ was successful. Some useful insights were obtained while observing the continuous, emission spectrums and the energy transitions leading to
their formation. For Incandescent light source the wavelengths generated was found to be in the range from 420.55 nm to 693.1 nm. For CFL light source, the average energy loss during collisions was found out to be 2.598 eV. Also, for LED source the photons produced were having wavelengths in the range from 426.75 nm to 680.49 nm. Subsequently, for KMnO₄ solution it was observed that it absorbs light in the green region of the visible spectrum in the range from 483.67 nm to 613.14 nm and emits red and blue light having energies 2.07 eV and 2.71 eV respectively.

ACKNOWLEDGMENT

I feel great in writing report acknowledgement and I will like to say some good words for those who stood by my side in my writing task. I am extremely grateful to the many people who have helped me in the study for and preparation of this experiment. First and foremost, I want to thank my professor Dr. Ramesh Thamankar, for his guidance, help and motivation in this experiment. The joy and enthusiasm he has for research was motivational for me, during this project time. Then I would like to thank my group mates. Their enthusiasm for pursuing daunting problems in physics at the highest levels of scientific integrity and rigor has been a constant source of inspiration, excitement, advice, and guidance throughout my experiment. I deeply thank them for the unprecedented freedom he offered to explore my intellectual curiosity in our experiments, and for fostering my capacity critically as an independent researcher.

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Assessment of quality of life of children with cancer undergoing chemotherapy in Moi Teaching and Referral Hospital

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Abstract - The incidence of cancer globally has been on an upward trend in the past decade. Promotion of quality of life (QoL) for children with cancer has become a priority in pediatric research and clinical care. The QoL reflects individual perceptions of the impact of illness on overall, physical, functional, emotional, social, and spiritual well-being. Many studies have indicated presence of a high degree of symptom-distress leading to poor patient and family outcomes. This research assessed the quality of life of 52 paediatric cancer patients undergoing chemotherapy at Moi Teaching and Referral Hospital (MTRH) Eldoret, Kenya. A cross-sectional analytical design was applied and the Lansky scoring table was used for data collection. Data was analysed using the statistical package for social sciences (SPSS) and presented descriptively. The findings revealed that most patients had a moderate QoL.

Index Terms - Quality of life, paediatric, cancer

I. INTRODUCTION

Quality of Life is a subjective multidimensional construct reflecting functional status, psychosocial wellbeing, health perception and disease- and treatment-related symptoms (Lis, Gupta, Lammersfeld, Markman & Vashi, 2012). According to Marín, Laviano & Pichard (2007), QoL assessment has been used as an important tool for studying the impact of disease, drawing up indicators of disease severity and course and predicting treatment efficiency. In oncology, the patient’s general health status directly impacts QoL, which, in turn, is influenced by a broad range of nutritional factors. The importance of measuring the QoL in patients undergoing cancer treatment has been acknowledged, as information about it could contribute to improvements in management and further improve the quality of life. For example, knowledge about a patient’s QoL might influence decision-making regarding choices between alternative treatments, or initiating appropriate intervention if QoL is deteriorating. Quality of life has until recently, been underexplored in children with cancer (Malihi et al., 2013).

According to Meeske et al., (2004) quality of life assesses the performance status and attempts to quantify the general wellbeing of patients with cancer. This measure is used to determine whether they can receive chemotherapy, whether dose adjustment is necessary and as a measure for the required intensity of palliative care. It is also used in oncological randomized controlled trials as a measure of quality of life. The Lansky Play Performance Scale (LPPS) is among the most frequently used instruments to assess the functional performance capacity and wellbeing in paediatric oncology patients which is also recommended for use by WHO (Lansky, List, Lansky, Ritter-Sterr & Miller, 1987). The LPPS is designed to assess general quality of life and physical performance status in children through rating their usual play activity. It includes a spectrum of age-appropriate play described with varying participation in active and quiet activities, ranging from ‘unresponsive’ to ‘fully active, normal’ functioning. The maximum score is 100 (‘fully active, normal’) and the worst possible score is 0 (‘unresponsive’). Scores 0-40 is classified as poor QoL, 50-70 moderate QoL and those with a score 80 and above the QoL is rated as good (Lansky et al., 1987). Other most frequently used instruments to assess the functional performance capacity are; the pediatric advanced care-quality of life scale (PAC-QoL) (Cataudella et al., 2014), pediatric cancer-specific quality-of-life (QoL) instrument (Anthony et al.,2013) and Cancer Module Peds-QL (Bariah, Roslee, Zahara, & Norazmir, 2011).

II. OBJECTIVE OF THE STUDY

The main objective of the study was to assess the quality of life (QoL) of children with cancer aged (1-17) years undergoing chemotherapy in MTRH, Eldoret.
III. METHODOLOGY

Research design
The study adopted a cross-sectional analytical method (Gravetter & Forzano, 2011) to assess the quality of life of paediatric cancer patients who were undergoing chemotherapy at Moi Teaching and Referral Hospital.

Study population
The study targeted children aged between (1-17) years on chemotherapy who attended the Hemato-oncology clinic in MTRH Uasin Gishu County.

Sample size
Using the fisher formula and the finite population correction factor a sample size of 52 was used in the study.

Sampling Techniques
Purposive sampling was used given that there was a small population of approximately 20 patients per month on chemotherapy. The study used all the eligible participants until the required sample size of 52 was obtained.

Research Instruments
Lansky scoring table was used to rate the cancer patients play activity. It included a spectrum of age-appropriate play described with varying participation in active and quiet activities, ranging from ‘unresponsive’ to ‘fully active, normal’ functioning. The maximum score is 100 (‘fully active, normal’) and the worst possible score is 0 (‘unresponsive’).

Pre-Testing of instruments
The questionnaires were pre-tested to check on the length, content, question wording and language. The questionnaire was administered to five respondents in the paediatric oncology unit in Kenyatta National Hospital.

Data analysis and presentation.
Data was entered and analyzed using SPSS version 21 and presented in the form of a table of frequencies and percentages.

IV. FINDINGS AND DISCUSSION

Majority of the respondents (n=20, 38.5%) had a lansky score of 60 while slightly more than a fifth (n=11, 21.2%) of the respondents had a lansky score of 50. One sixth (n=7, 13.5%) of the respondents had a lansky score of 70 and 40 each. Six (11.5%) respondents who aged above15 years managed to score a lansky score of 80 which was the best score among the respondents. The lowest score (30) was scored by one respondent aged between 18-23 months as shown in table 1.

Table 1: Quality of life of the respondents

<table>
<thead>
<tr>
<th>Age</th>
<th>80.00</th>
<th>70.00</th>
<th>60.00</th>
<th>50.00</th>
<th>40.00</th>
<th>30.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respondents below 5 years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-17 months</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18-23 months</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>24-35 months</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>36-47 months</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>48-59 months</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Respondents 5 years &amp; above</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-10 years</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>11-15 years</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Above15 years</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

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The lansky score of 60 among majority of the patients indicates moderate QoL which meant, moderate restrictions with varying amount of assistance was needed especially in their involvement in active quieter activities. A study that analyzed the Quality of Life in children with cancer found a relatively similar mean value of QoL (62.3) for the whole group (Fawzy1, Saleh, El-Wakil, Monir & Eltahlawy, 2013). In the present study the worst score (30) was scored by a respondent aged between 18-23 months showing that he had poor QoL and therefore needed considerable assistance even for quiet play activities. The study conquers with that by Hamidah et al., 2011 who found that younger child age was associated with lower scores \( P = 0.007 \). Generally the current study found that the cancer children had poor QoL. This finding is supported by Batra, Kumar, Gomber & Bhatia, (2014) and Bansal, Sharma, Vatsa & Bakhshi (2013), who found that the overall QoL of children with cancer was significantly poor.

V. CONCLUSION

Generally the current study found that the cancer children had poor QoL. The patients therefore require some assistance in participation in play and other activities.

VI. RECOMMENDATION

The majority of the patients indicated moderate QoL which meant, moderate restrictions with varying amount of assistance was needed especially in their involvement in active quieter activities. This was as a result of their disease, its treatment, or both therefore there is need to have a comprehensive policy agenda that links improved health care delivery and follow-up, investments in education and training for health care providers, and expanded research to improve the long-term outlook for this growing population.

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Meta-Analysis: Assessing the Role of High Fat Diet as a Risk Factor for Prostate Cancer

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Abstract- Dietary intake has been implicated as one of the factors associated with prostate cancer. This study is aimed at assessing the role of high fat diet as a risk factor for prostate cancer. Articles were reviewed which included case control studies, cohort studies or randomized clinical controlled trials published between 1997 and 2017 that focused on the role of high fat diet as a risk factor for prostate cancer in humans. Ten (10) articles were then selected based on the relevance to the research topic and most recent of the articles. Out of the ten articles selected and reviewed, four were prospective cohort studies with sample sizes ranging from 525 to 10,564 participants, while six were case control studies with sample size ranging from 90 to 932 participants. The meta-analysis was performed by using multivariable adjusted HR, OR or RR and forest plots were created for all studies reviewed. The results revealed that most of the studies showed a strong association between high fat diet and prostate cancer incidence and mortality with statistically significant results (p<0.05). However, two of the articles did not find any significant association (p>0.05) between high fat diet and prostate cancer risk. The results of this study provided evidence to prove that there is a statistically significant association with the role of high fat diet implicated as a risk factor for prostate cancer.

Index Terms- Prostate Cancer, Meta-analysis, High Fat Diet, Risk Factor, Mortality

I. INTRODUCTION
Prostate cancer is a major cause of cancer related deaths in the U.S. It is the world’s second most diagnosed cancer and the fifth leading cause of cancer deaths in males [1]. In the United States, it is the second most common cancer in males and the 6th leading cause of cancer death [2]. It is estimated that 1 out of every 11 men will be diagnosed with prostate cancer at some point in their lifetime with the likelihood of this number increasing with advancing age. Over 3 million men were estimated to be living with prostate cancer in 2018 with 174,650 estimated new cases and 31,620 estimated deaths reported in 2019 [2]. Despite the overall decline in mortality rates in recent decades due to early diagnosis with screening measures such as prostate specific antigen (PSA), digital rectal examination (DRE) and improved treatment modalities, prostate cancer remains a major source of concern among men [3]. Several risk factors predispose to prostate cancer. According to the American Cancer Society, race/ethnicity, age and family history of prostate cancer are the only established risk factors of prostate cancer [4].

A wide range of additional risk factors have been examined as potential risk factors for prostate cancer although evidence around the association is still a work in progress [5]. Dietary fat is a fundamental contributor to obesity and of the many lifestyle factors; high fat diet is considered a risk factor for prostate cancer [6]. Obesity share a complex relationship with prostate cancer through signaling pathways that alter cell proliferation and angiogenesis [6]. According to Discacciati, [7], it is also associated with increased incidence of high-risk and aggressive prostate cancer. Lifestyle changes in dietary fat intake may therefore help ameliorate some of the negative outcomes associated with prostate cancer and survivorship [7]. Considering the various roles of high fat diet on the incidence of prostate cancer, this study is aimed at determining the role of high fat diet as a risk factor for prostate cancer. This will help inform healthy dietary patterns to decrease the incidence and mortality from prostate cancer.

II. METHODS
A PubMed search for the topic ‘high fat diet risk factor for prostate cancer yielded an initial 172 results. The meSH search terms were ‘prostatic neoplasm, diet, high fat diet, and risk factors. Filters were subsequently applied to focus on the most relevant articles. 2.1 Eligibility Criteria

Articles reviewed included case control studies, cohort studies or randomized clinical controlled trials that focused on the role of high fat diet as a risk factor for prostate cancer in humans. Articles between 1997 to present were included while meta-analysis or systematic review articles were excluded. Articles with titles and abstracts that were not relevant to this paper were also excluded. Ten (10) articles were then selected based on the following criteria; relevance to the research topic and most recent
of the 147 articles. Figure 1 below shows a flow diagram for the inclusion and exclusion of studies.

2.2 Data analysis

The meta-analysis was performed by using multivariable adjusted HR, OR or RR as provided in the studies. The specific software used to create the forest plot was evidence partners (https://www.evidencepartners.com/resources/forest-plot). Forest plots were created for all studies reviewed. Plots for the cohort studies and case control studies were also created to make comparative analysis using the subgroups.

Figure 1. Flow Diagram for the inclusion and Exclusion of Studies.

III. RESULTS

Ten (10) studies were reviewed for this meta-analysis. These were studies from different countries published between 1997 and 2017. Of these studies, four were prospective cohort studies with sample sizes ranging from 525 to 10,564 participants, while six were case control studies with sample size ranging from 90 to 932 participants. The prostate cancer cases were histologically confirmed cases and their dietary pattern was assessed using a self-administered food frequency questionnaire to determine their intake of high fat diets compared with other diets. The hazard ratio (HR), odd ratio (OR) or relative risk of these studies were extracted from the papers and these were adjusted for age, race, total energy intake, body mass index (BMI), alcohol, smoking, family history of prostate cancer, tumor grading, primary treatment and other factors, using the multivariable adjustment model. While most of the studies showed a strong association between high fat diet and prostate cancer incidence and mortality with statistically significant results (p<0.05), Yang et al [8] showed some association between high fat diet and prostate cancer which was however not statistically significant (p>0.05). Two others [8, 9] did not find any association between high fat diet and prostate cancer risk. The table below summarizes the articles analyzed.

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<table>
<thead>
<tr>
<th>Article</th>
<th>First author’s last name</th>
<th>Year of publication</th>
<th>Location</th>
<th>Type of study</th>
<th>Sample size</th>
<th>Method of Assessment of the Health Condition</th>
<th>Methods of Assessment of the Risk Factor</th>
<th>Adjusted OR or RR and their 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diary intake in relation to prostate cancer survival</td>
<td>Downer [10]</td>
<td>Feb 22, 2017</td>
<td>Orebro County, Sweden</td>
<td>cohort</td>
<td>525 prostate cancer patients</td>
<td>Patients diagnosed following prostate-related symptoms and confirmed with histology by study pathologist with tumor stage assigned according to WHO TNM classification system</td>
<td>Self-administered food frequency questionnaire</td>
<td>HR: 6.10, 95% CI: 2.14-17.37 P-value= 0.001, multivariate-adjusted model (adjusted for age at diagnosis, calendar year at diagnosis, non-alcohol energy intake, height, BMI, smoking status, alcohol consumption, tumor grade, family history, primary treatment, low fat and high-fat milk).</td>
</tr>
<tr>
<td>Milk and other dairy foods in relation to prostate cancer recurrence: Data from the cancer of the prostate strategic urologic research endeavor (CaPSURE)</td>
<td>Tat [9]</td>
<td>Nov 6, 2017</td>
<td>United States</td>
<td>Prospective study (cohort)</td>
<td>1334 men with non-metastatic prostate cancer</td>
<td>Biopsy-proven prostatic adenocarcinoma</td>
<td>Validated semi-quantitative Food frequency questionnaire</td>
<td>HR: 2.96; 95% CI:1.58-5.54, P-value &lt;0.001 multivariate adjusted model (adjusted for age at diagnosis, daily calories, years from diagnosis to FFQ, pretreatment CAPRA score, smoking status, BMI, walking pace, primary treatment)</td>
</tr>
<tr>
<td>Dairy intake after prostate cancer diagnosis in relation to disease-specific and total mortality</td>
<td>Yang [8]</td>
<td>Nov 15, 2016</td>
<td>United States</td>
<td>Prospective study (cohort)</td>
<td>926 men with non-metastatic prostate cancer</td>
<td>Biopsy-confirmed prostate cancer patients</td>
<td>Food frequency questionnaire</td>
<td>RR: 2.41, 95% CI:0.96-6.02. P value=0.04 multivariable adjusted model (adjusted for BMI, smoking status, vigorous exercise, time interval between diagnosis and completion of FFQ, Gleason score, clinical T stage, PSA levels at diagnosis, initial treatment, family history of prostate cancer, data-derived dietary patterns)</td>
</tr>
<tr>
<td>Diet, lifestyles, family history, and Prostate Cancer Incidence in an East Algerian Patient Group</td>
<td>Lassed [13]</td>
<td>Oct 19, 2016</td>
<td>East Algeria</td>
<td>Case-control</td>
<td>90 patients and 190 controls</td>
<td>Histologically confirmed prostate cancer</td>
<td>Questionnaire</td>
<td>RR: 3.02, 95% CI 2.17-4.20. P value &lt;0.0001</td>
</tr>
<tr>
<td>Dietary fat and early-onset prostate cancer risk</td>
<td>Lophatananon [14]</td>
<td>January 19, 2010</td>
<td>United Kingdom</td>
<td>Case control</td>
<td>512 cases and 838 controls</td>
<td>Histologically confirmed prostate cancer patients</td>
<td>Self-administered Food frequency questionnaire</td>
<td>OR:2.53, 95% CI: 1.72-3.74. P value &lt;0.001 multivariable adjusted model (energy adjustment, age, one or more first-degree relatives with prostate cancer, and baldness in the 4th decade of life).</td>
</tr>
<tr>
<td>Study Description</td>
<td>Author [Ref]</td>
<td>Date</td>
<td>Location</td>
<td>Design</td>
<td>Number of Cases and Controls</td>
<td>Case Identification</td>
<td>Questionnaire Description</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>------------</td>
<td>---------------------------</td>
<td>------------------</td>
<td>------------------------------</td>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Association of energy, fat, calcium, and vitamin D with prostate cancer risk</td>
<td>Kristal [15]</td>
<td>Aug 11, 2002</td>
<td>King County, Washington</td>
<td>Case-control</td>
<td>605 cases and 592 controls</td>
<td>Histologically confirmed prostate cancer cases identified from Seattle-Puget Sound SEER cancer registry</td>
<td>Self-administered food frequency questionnaire</td>
<td>OR: 2.01, 95% CI: 1.03-3.92. multivariable adjusted model (age, race, family history of prostate cancer, education, BMI, number of screening PSA tests within 5 years before reference date, total energy intake, nonfat sources of energy.</td>
</tr>
<tr>
<td>Dietary factors and risks for prostate cancer among blacks and whites in the United States</td>
<td>Hayes [16]</td>
<td>Jan 8, 1999</td>
<td>United States</td>
<td>Case-control</td>
<td>932 cases and 1201 controls</td>
<td>Pathologically confirmed prostate cancer cases</td>
<td>Food frequency questionnaire</td>
<td>OR: 2.8, 95% CI: 1.3-5.9. P value= 0.04. multivariable adjusted model.</td>
</tr>
<tr>
<td>A prospective study on dietary fat and incidence of prostate cancer</td>
<td>Wallström [17]</td>
<td>August 29, 2007</td>
<td>Malmo, Sweden</td>
<td>Cohort study</td>
<td>10,564 individuals</td>
<td>Ascertained by record linkage with the national Cancer Register</td>
<td>A seven-day menu book, a questionnaire, a 45-min complementary interview</td>
<td>RR: 0.92, 95% CI: 0.74-1.14. Multivariable adjusted model (adjusted for total energy intake, age, diabetes, BMI).</td>
</tr>
<tr>
<td>A case-control study of diet and prostate cancer</td>
<td>Key [18]</td>
<td>1997</td>
<td>Oxford shire, West Berkshire and Leeds</td>
<td>Case-control</td>
<td>328 cases and 328 controls</td>
<td>Biopsy-confirmed prostate cancer cases</td>
<td>Dietary questionnaire adapted from the food frequency questionnaire</td>
<td>OR: 1.00, 95% CI: 0.69-1.45. Adjusted for social class</td>
</tr>
<tr>
<td>Case-control study of diet and prostate cancer in China</td>
<td>Lee [19]</td>
<td>1998</td>
<td>China</td>
<td>Case-control</td>
<td>133 cases and 265 controls</td>
<td>Histopathologically confirmed prostate cancer cases</td>
<td>Questionnaire</td>
<td>OR: 3.6, 95% CI 1.8-7.2. P value &lt;0.01. multivariable adjusted model</td>
</tr>
</tbody>
</table>
3.1 Meta-Analysis of the Studies

The multivariate adjusted HR, RR or OR and 95% confidence intervals (95% CI) based on the study, were used for the meta-analysis. The forest plot was arranged in a chronological order from the most recent of the studies analyzed to the oldest. The sizes of the square were made proportional to the sample size of each study. Of the 10 studies analyzed, 7 showed statistically significant association between high fat diets as a risk factor for prostate cancer. Although Yang et al [8] showed an association between high fat diet and prostate cancer, this was found not to be statistically significant. However, 2 other studies [8, 9] found no statistically significant association between prostate cancer risk and high fat diet. The diagram below shows a forest plot of the studies analyzed.

![Forest Plot of Studies on High Fat Diet and Prostate Cancer Risk](image)

A subset analysis was done to compare the studies based on study type; case-control studies and cohort studies.

3.2 Based on study type

The studies were stratified into case-control studies and cohort studies. Six (6) of the studies analyzed were case-control studies while the other 4 were cohort studies. The association between high fat diet and prostate cancer appeared to be stronger with the case control studies compared to the cohort studies as 5 out of the 6 case-control studies showed a statistically significant association unlike the cohort studies in which only 2 out of the 4 studies showed a statistically significant association. However, significant difference existed in the sample sizes when comparing both groups as the case-control group appeared to have smaller sample size compared to the cohort group. Notably, the study with the largest sample size which was a cohort study did not support an association between high fat diet and prostate cancer risk. Figure 3 and 4 show forest plots of the two subgroups.
IV. DISCUSSION

The relationship between high fat diet and the onset of prostate cancer has been previously discussed and reported [8]. Several other studies have strongly agreed that dietary habits are the most implicated factor that is related to cancer [10].

The results of that revealed a strong association between high fat diet and prostate cancer incidence and mortality with statistically significant results. This is in line with the study of Downer et al., [10] where they reported that dietary fat such as butter was associated with increased levels of prostate cancer mortality. Also, the reports of the Health Professionals Follow-up Study (HPFS) and the Physicians’ Health Study (PHS) supported the claims of this study. They observed that increased milk intake was associated with increase in prostate cancer progression [11].

Investigations by Pettersson et al. [12] revealed that dietary fats increased the risk of chronic prostate cancers. However, the associations of high fat diet with increased prostate cancer progression have also been reported among men with chronic prostate cancer. This is however attributed to be due to increased levels of circulating IGF-1 which may promote cancer onset [10].

The outcome of the meta analysis conducted by this study agreed with the result of where significant association was found between high fat diet and prostate cancer [9, 10, 13], while other studies conducted by Yang et al., [8] revealed an association between dietary fats and prostate cancer, though this observation was not significant. The discrepancies in the results could be attributed to methods of evaluation, variations in the type of evaluation used by the researchers and the state of wellbeing. Also, variations could also be attributed to the period of review, the search methods and type of analysis.
In line with the above, it is important to note that this study involved reviews of ten articles that are relevant to the research topic and analyzed to provide significant correlation between high fat diet and onset of prostate cancer. This study will serve a general purpose in the future wherein conclusions from this study will be further used to make useful prognosis and monitoring of prostate cancer progression which has in turn contributed to existing knowledge.

Although studies have established the role of obesity in carcinogenesis, researches on the role of high fat diet as a risk factor for prostate cancer are yet to reach a consensus [3, 10]. Some results show that there are statistically significant association between high fat diet and prostate cancer risk, while others do not. This meta-analysis of studies on the research question was done to determine what opinion is favored based on scientific validation. While differences in results still exist in the articles reviewed, most of the articles show a statistically significant association with the role of high fat diet as a risk factor for prostate cancer.

The strength of these studies in making this association include that patients used for these studies were histologically diagnosed and confirmed cases and not relying on prostate specific antigen (PSA) or digital rectal examination (DRE) which may identify false positive cases. Also, cofounders that may affect results were adjusted for in these studies. The risk assessment used for all the studies were validated food frequency questionnaires that were designed to suit the peculiarities on the environment were these studies were done. However, this may also be a limitation of these studies as the subjectivity in filling out these questionnaires may not favor an objective result. Also, these questionnaires accessed dietary intake for a limited period making the assessment of dietary patterns of intake over time, difficult. Recall bias may have affected the results as patients with prostate cancer may tend to make more association with high fat meal as a way of making an explanation for the disease. Most of these studies also focused on particular population limiting the generalizability of these results. The case-control studies which made most of the statistically significant association had used smaller sample sizes compared to the cohort studies. Future direction that research could ideally take to more conclusively answer the question would be to use more objective ways to determine high fat intake in addition to the food frequency questionnaire such as blood tests. In addition, larger scale studies involving larger sample size may also help in making a more generalizable conclusion.

V. CONCLUSION

This meta-analysis has gone on to show a statistically significant association between high fat diet and prostate cancer risk. While there is still room for more research to validate this claim, these results are substantial enough to encourage healthy diets low in fat content as a preventive measure for prostate cancer.

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Digitalization of Lean Tools – Digital A3

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Abstract - Digital transformation creates the balance of the world and positively affects the way of living, hobbies, health and even industries. In the manufacturing world, the Industrial revolution is based on the digital transformation of the process which brings the advantages and increases the capabilities of companies. Manufacturing companies have used the lean tools and principles in order to reduce operational complexity and increase the production rate over decades. In fact, since the complexity of operations has increased from last few decades, difficulties raised for managing operations only with the traditional methods or lean tools. Due to emerging the Industry 4.0 revolution, new approaches offered to solve the complicated problems and improving productivity. For industries, it’s important to decide how to involve or add Industry4.0 into their own working culture and manage their transformation process. The purpose of this paper is to study the requirement of digitalization of lean tools and its implementation for making the Plan-Do-Check-Act (PDCA) cycle through A3 reporting digital. This work emphasizes the ABC tools supported with VBA excel. It is decided to make the working prototype enabling A3 reporting by using lean concept and correlation of continuous improvement with the A3 thinking. Finally, the testing phase is on-going with few industries to understand feasibility and advantages of its usage.

Keywords: Lean Manufacturing, Continuous Improvement, Digital A3 report, Industry 4.0 revolution)

I. INTRODUCTION

Lean tools and lean management concept are used in the manufacturing and service companies for many years. Besides, digitalization is a new, rising trend in the world the main purpose of this work is to digitalize the principles of lean manufacturing and successfully implement. A combination of digitalization and lean management can be beneficial to the industry. Previously big analysis has made to understand what the missing points in the business life, how digital A3 can improve for the companies' usage and which problems should be focused to increase the biggest problematic areas. As a result, the prototype had been created of a new digital tool, which is called Polikaizen, for the companies that want to combine the advantages of technology and lean tools which works under the A3 thinking principles. Lean concept provides numerous benefits to the companies. Companies which adopt a lean concept increase their productivity, product quality, and efficiency because of the fact that lean management eliminates the wastes, non-added value activities and costs. It allows companies to decrease the number of scraps, reworks and customer returns. Not only companies that adopt the lean idea, but also stakeholders which works with these companies increase themselves. Employees can find a chance to increase their own skills, so people development and knowledge sharing among the whole departments increase. Moreover, customer loyalty and satisfaction rise in light of the fact that companies provide better product and service with quick response time. Apart from the lean concept, digitalization has also great benefits for the companies adopting the technology. For example, digitalization leads companies to save time and money due to the fact that it reduces the time losses for data collection and improves communication between departments. Digitalization causes better decision making and resource utilization. Also, it increases the flexibility and competition level of the company.

In previous work which had done by lean excellence center of MIP, Polimi for the Tool name as Polikaizen from that focus was the digitalization and hence to understand the missing points and areas needed to be improved, the survey is performed by 71 lean experts. Experts analyze that digitalization of lean tools provides some benefits to the companies. Moreover, they have evaluated the efficiency of PDCA as well as A3 used in their companies. It is observed that the importance of digitalization of the A3 depends on the tools used for A3 reporting. Tools such as Pareto Chart, Fishbone Diagram, 5 whys, VSM etc. has been used while analyzing it. Additionally, experts think that most challenging topics to perform A3 in the company are involving the employees, the contribution of the top management, communication between departments, tracking of the steps and respecting of the deadlines.

After reviewing the above survey that a new digital tool should be created by respecting the experts’ opinions. Digital tool, Digital A3 is created to perform PDCA which is easier for companies. It is designed to use for engineers and managers; hence managers can perform their management roles without losing internal roles or structure of the program while engineers are responsible to use all tools included in prototype. Polikaizen allows companies to personalize the program according to their company features. So, after completing basic settings, each company is able to use the program without any problem. All ideas of experts are taken into account during the creation of the prototype by respecting results of the survey.

For instance, templates for many of the tools we can get it easily online but to bring all these tools in one platform where A3 reporting will be done is very important. Which will reduce the time of the engineer and evaluate the all tools in terms of the amount of cost saving and time-saving and evaluate the
performance of all people in the projects. It improves the communication between departments since it pushes people from different departments to work together within deadlines. Also, A3 digital decreases time-consuming during data collection and analyses thanks to the digitalization of the processes. As a result, digital A3 is designed by considering the ideas of experts and the survey result to solve the problems that companies faced during the A3 reporting. To digitalized the process and to determine the aim of the topic, main thing it has to be done is to understand the lean thinking process and working process of A3 to make the system in continuous improvement. Conclusion will be evaluated by the detailed scenario obtained while understanding the thinking process and implementing it for the prototype.

II. PROBLEM STATEMENT AND LITERATURE SURVEY
In today's innovative and digital world everything has to be digitalized to reduce the work pressure and to make it easy and error free. This paper is based on the same scenario of digital world. This consists of the theory of lean concept, CI concept, A3 thinking framework and how all these are important and interrelated in this digitalized world. By considering all this concepts and as per the industrial requirement this paper is made and it consists of an innovative idea of Digital A3 by taking the help of digital PDCA prototype made by lean excellence center of polimi, Italy.
This chapter describes the theory about the lean management and its correlation with the A3 thinking report to understand the importance of digitalization in this era of industrialization by following theories.

Lean management
Lean Thinking is the practice of concentrating on the processes that create the values by reducing wastes from it. Toyota, a Japanese company proposed Lean concept first. This research had been done in the twentieth century. The founder of the system was Sakichi Toyoda, his sons Kiichiro Toyoda and Eiji Toyoda as well as Taiichi Ohno (1), a manufacturing engineer. Sakichi Toyoda then started working in the textile industry where he invented a motor driven loom with the specialized technique devised to stop in case of breaking off the thread (2).
That mechanism then became foundation of Jidoka, one of the two main pillars on which Toyota production system is standing. Due to this lean management i.e. defect detection system, it was observed that defects occurring due to human errors were reduced and the production capacity was increased (3).

Lean system is also known as follows, each label highlighting a particular principle of Lean Thinking:

“Just-in-time Production System” - Just-In-time is developed by Taiichi Ohno (4) and his colleagues at Toyota, which is one of the pillars of TPS (1). It means to supply to each process what is needed, when it required and how much quantity is required. Just-in-time allows to deliver the right amount of product at right time. It is the classic Pull system. When the production is initiated at the next or higher level then only the bottom line will produce the product i.e. Units are produced due to pull system from the higher level. The main purpose of Just-in-time manufacturing is to reduce lead time and stock holding time which can be achieved by reducing the work in process. Fig. No. 1 shows the Pillars of Lean and the Toyota Production System in which JIT pillar is one of the pillars.

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Fig. No. 1 (Pillars of Lean and the Toyota Production System)
“Kanban System” – Kanban System, a major tool of lean thinking which is one of the lean transformations from 1980s (5). In this concept, a downstream process uses the part from the upstream process. After use of every part, Kanban card is removed and sent back to the upstream process. When predetermined number of cards are collected at the upstream process, production refill the stock which is used by the downstream process. The basic principle behind the Kanban is to linking the supplier and the customers to the process which helps them to understand the behavior of each other through the formal request. It’s a process of lean thinking which will helps to develop the process by reducing the waste. It is also the behavior to develop the customer and supplier relations. Fig No 2 shows the working procedure of the Kanban system in which it shows how the upstream process receives a Kanban card from the downstream process to reduce the inventory of the product.

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www.ijsrp.org
“One-piece Flow System”. Toyota Production System is also called as “One-piece-flow” production system. Lot and batch sizes has to reduced and make it one-piece production or small batch production. Standard manufacturing systems which has focus on the big lot production and continuous production to achieve the requirement in time and having long set-ups will generate over production and creates large inventories for the next station. Hence to make smaller batches, TPS focuses on set time reduction. So that A TPS line can operate as a mixed model line. It means, it can produce or assemble different models at the same time without changing setup time. Products from One-piece flow lines are good in quality and every station are highly productive to take care of every piece before delivering to the next station. Defects get reduced due to single piece production because of high concentration on one piece. Fig. No. 3 show how one-piece flow production systems works which help to reduce the over production

Fig. No 2 (Working of Kanban Process)

1. Let go of assumptions
2. Be proactive about solving problems
3. Don't accept the status quo
4. Let go of perfectionism and take an attitude of iterative, adaptive change
5. Look for solutions as you find mistakes
6. Create an environment in which everyone feels empowered to contribute
7. Don't accept the obvious issue; instead, ask "why" five times to get to the root cause
8. Cull information and opinions from multiple people
9. Use creativity to find low-cost, small improvements

Kaizen works in seven steps in the cyclic way in which the problems are addressed inadequately. It involves identifying issues and opportunities, creating solution and rolling out them. These following seven steps create a cycle of continuous improvement and give proper way to implement them and execute them after success. (Fig. No. 4)
A3 framework

A3 problem solving is a structured problem solving and continuous Improvement approach which is first implemented by Toyota and specifically used for Lean manufacturing scenario. It provides a simple strict procedure that guides problem solving by workers. The approach specifically uses a single sheet ISO A3-size paper, by which the name has given as A3 framework. (8, 9) (10). A3 thinking consists of 8 parts which has to be plotted on the A3 paper. It follows the process from determining the problem to the solution and the follow up. A3 thinking is mostly develop with the help of PDCA cycle. From the previous work done about the PDCA cycle, 8 parts of the A3 thinking is segregated into the Plan-Do-Check-Act process. A3 thinking consists of following 8 parts which comes under PDCA: (11) (12).


A3 can be applied for many varieties of applications. But it’s a tool basically for the people with open-ended mind for problem solving. It is recommended to use A3 daily to solve small problems like “why did the machines fail?” by the operator. It can be used on strategic as well as corporate development problems like “why did market growth drop?” by the executives. These questions describe the thinking level of the managers more often just discussion and exchange of words. Does this thinking process improved you? Or does it help others? Instead of focusing on “Who” is responsible for the Problem, A3 thinking allows you to think about “Why” this problem occurred? Many organisations use A3 as an “A3 Counselling”. It addresses the problem occurred due to manual error. Instead of blaming personally, they help each other to think about the problem or error occurred and helps to fix it. Hence A3 counselling goes from blame to improvement process and learning. Working with the team is more effective because while applying A3, organisational or personal issues become good starting point than the different problem-solving tools. Hence A3 can be used for daily issues by which organisational performance will improve. (13) (14)

A3 thinking is the collaborative way to improve the process and to reduce the problems and waste. Due to the huge size of A3 paper, teams have to focus on each A3 on a complicated or broadly compelling decision or a single size to mid-size problem. If A3 will be done correctly, then project updates can provide for senior oversite and can give faster input and feedback. A3 is the historical record of issues by which we can determine the process of improvement and take the corrective action if the same problem will occur in the future and how the respective team deal with it. This can be a useful document to refer for the juniors to understand the process and the methods used to solve the problem. A3 increase the confidence with senior leadership. Other advantages are:

- Root causes Identification
- Useful information to reference throughout the project can be put on the Dashboard for further studies.
- Team members can share knowledge for problem solving thinking.
- Reaching consensus among team members; and,
- Promoting deliberative, thoughtful decision making.

A3 process is good for learning and can be used as a learning tool. All the team members can sharpen their problem-solving skills. Making an A3 without knowledge will leads to creation of waste. Hence A3 is good and learning tool by which organisation can reduce the waste formation and encourage people to develop their problem-solving skills. (8, 9)

Digitalization of A3

Digital A3 will be a digital platform where you can perform all the analysis and process which now a days are doing manually. It will contain all the analysis tools by which it will be quite easy to solve the problems which can raise in regular life or in day to day life of the organization. Digital A3 will be an application made by using IoT concepts. Which will contain tools of lean management analysis like Pareto, Fishbone diagram, 5 whys etc. These tools will perform their functions by which Process can get connected with the top corporate management with the bottom management by which they can keep all the process working perfectly and they can also reduce the time of Performance.

Digital A3 will be so helpful for the organisation. It will serve the purpose of A3 thinking in shorter period of time and it will directly connect all the stages of manufacturing with each other. It also helps personally to everyone for understanding the other process by ease. It helps the supervisors to know exact problem and type of problem so they can take corrective actions as early as possible. (15)

Digital A3 will be a simple application-based tool to serve the purpose. It will one of the best inventions of industry 4.0. Digital A3 will be a best tool for the organisation to adapt and to learn.

III. Survey and Implementation

Survey Report

Our first step was to do the survey in which 71 participants participated. Survey had been done for knowing the requirement of digitalization of lean tool and they found the data from the survey by considering age, gender, education and work experience as a demographic data. The data from survey showed that, 83.3% participant in the survey were in 26-45 ages while 13.9% participants were above 45 age and 2.5% were in 18-25 ages. Secondly, 76.4% were male and 19.4% were female and remaining participants didn’t tell their age. Many of the participants are master’s degree pursued candidates while some of them were bachelors, doctorate and high school finished candidates. From these educated candidates most of the participants were having experience more than 5 years and some of them were between 1-2 years of experience.

After collecting the demographic data, I surveyed the list of lean tools which industries uses (Table 1) and which tool has to be digitalized (Table 2)
Table 1: List of lean tools used by industries

<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Number of Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>38</td>
</tr>
<tr>
<td>Value Stream Mapping</td>
<td>26</td>
</tr>
<tr>
<td>PDCA</td>
<td>20</td>
</tr>
<tr>
<td>Kanban</td>
<td>20</td>
</tr>
<tr>
<td>Visual management</td>
<td>16</td>
</tr>
<tr>
<td>A3</td>
<td>13</td>
</tr>
<tr>
<td>SMED</td>
<td>11</td>
</tr>
<tr>
<td>Ishikawa diagram</td>
<td>9</td>
</tr>
<tr>
<td>Kaizen</td>
<td>9</td>
</tr>
<tr>
<td>TPM</td>
<td>9</td>
</tr>
<tr>
<td>5W HY</td>
<td>7</td>
</tr>
<tr>
<td>DMAIC</td>
<td>5</td>
</tr>
<tr>
<td>One-piece flow</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2: Tools has to be digitalized identified from survey

<table>
<thead>
<tr>
<th>Tool Name</th>
<th>Number of Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kanban</td>
<td>9</td>
</tr>
<tr>
<td>A3</td>
<td>3</td>
</tr>
<tr>
<td>PDCA</td>
<td>3</td>
</tr>
<tr>
<td>KAIZEN</td>
<td>2</td>
</tr>
<tr>
<td>SOP</td>
<td>2</td>
</tr>
<tr>
<td>Fishbone-Diagram</td>
<td>2</td>
</tr>
<tr>
<td>VSM</td>
<td>2</td>
</tr>
<tr>
<td>FMEA</td>
<td>2</td>
</tr>
<tr>
<td>OEE</td>
<td>2</td>
</tr>
<tr>
<td>Value Stream Map</td>
<td>1</td>
</tr>
</tbody>
</table>

From the list obtained of tools has to be digitalised, our first step is to started designing of the prototype of digital tool of PDCA cycle. So, from the previous work done, I have decided to use the theory and study of previous work and implement that for making digital tools. Hence from table 2, we have decided to make the PDCA cycle digitalised by making Digital A3. For making it digital, what we have done is explained in the next part of implementation.

Implementation
Starting from the results of the survey, it’s been known that making the PDCA digital is quite important and essential. PDCA is based on the A3 thinking report. Digitisation of A3 reports basic functions has four steps.
1. Make PDCA cycle digital. Making the A3 digital, initial step is to understand and to brainstorm the PDCA functions of A3. To get the detailed view of the important functions from it, company will take decision according to their necessities. As an outcome of rigorous brainstorming, list of the functions is made which has to be considered in the different parts of the A3 report and listed out by its importance.

2. Select the most essential Function to discuss for this report, ABC analysis technique had been applied, by which clear picture came that which functions are so much important and has to be digitalized first by including in A3 digital. ABC analysis is a method of analysis that divides the tools into three categories: A, B and C. Category A represents the most valuable tool that we have. Tools which contributes heavily for the analysis. This category will be the smallest category. Category B represents the middle of the road tools. Tools from this category has the potential to shift into A category which can be valuable for analysis and Category C contains unimportant tools which increased the effectiveness of the whole system by working together but individually it is not important that much (14). After making this analysis, Pareto, Fishbone diagram, 5 Whys analysis, Value chain mapping, Benefits matrix, Waste management etc. found as the most important tools which has been selected for making it digital by using VBA excel tool. After selecting the tools from the A3 thinking which has to be digitalised, our working prototype which contain the A3 page. After filling the personal information part, the next part is to go with the A3 reporting part in which first step is identify the background of the problems. For that we can use 3 types of tools or functions like Pareto analysis, Value stream mapping and waste management, which can identify the problem and shows the way to solve that. For solving the problems firstly, we have to breakdown the problems which can be done by value stream mapping etc.

3. Target has to be set so that the study will proceed around that target.

4. Analysis of the root cause has to determine by using 5 whys, pareto or Fishbone diagram method. In the fifth and sixth step, development of counter measure by using tools like waste management or Benefits aspects matrix and Implementation of counter measures to test the system against the problem. After implementation of counter measure monitoring stage and improvement stage has to carried out by using tools like waste management or Benefit aspects matrix or Future value stream mapping. Every process has to go with these stages which will generate the A3 report. This research will make this report digital. To make this digital and to work all the functions of the tools, VBA excel is used to process the functions. It contains code to do all the functions after clicking and putting data at the proper place. So, the code which is called macro. Macro enables us to operate the functions as per command and direction. Every tool which is discussed further works under VBA excel macro code.

IV. Testing
The next step of our aim is to test the prototype with the companies for its feasibility and effectiveness. Similarly, take the comments from the respective guys to make it perfect and user friendly. A pilot has been created to test the tool and take the feedback from the companies with the help of survey. We gave our prototype to 10 companies for testing its feasibility and effectiveness. We started receiving comments from them. This testing phase is still in the process. Feedbacks which had it already from some of the industries are as follows. Similarly, it contains the improvement what have done as per their requirements.

a. A comprehensive sheet with all the analysis used (can be a picture of all the results of the analysis) is needed in the same excel file or in the new one.
- For this suggestion, used different tactic to get all the analysis in one folder. After finishing the use of A3 digital, it is mandatory to save it. When you will save your work then you will get each analysis ex. Fishbone, pareto etc in one folder which you can use or share for further studies. As per the suggestion, this part we have included in our future development which will be done as early as possible.

A new function on VBA has been created in order to allow the user to save all the sheets in PDF format and after saving all the data will get cleared automatically. To use this prototype again, user has to install or download this tool again which will resist the malfunctioning of the tool.

b. All the analysis may be done more than one time (with different data). It can be useful to make them replicable. At least one of each analysis for each box.

- This suggestion has been solved in the solution of first suggestion. Whenever the file be saved then all the data will get cleared and it can be used for how much times you want but as per the time bounding, we have set. Similarly, each box of A3 has minimum single of analysis except target and implementing counter measures.

c. It is not possible to write the target either the list of counter measure.

- This problem has been solved by providing space to list down the target and countermeasures.

For taking the feedback from the company, we have created the survey questionnaire from which received some feedbacks and some has to come. Survey contains 10 questions about the tool which we have created. Survey questions are as follows:

1. How would you rate the importance of the Digitalization of Lean management tools?
2. How would you rate the quality of our Digitalization of A3?
3. What is your first reaction to the product?
4. How innovative is our digital A3 thinking concept?
5. In our A3 thinking, which part you liked most?
6. When you think about our tool or concept, do you think of it as something you need or don’t need?
7. How likely are you ready to replace your manual work with the digitalized product?
8. How likely you would recommend our digitalized A3 thinking to a friend or colleague?
9. Which another lean tool you want to add in this digital A3?
10. In your own words, what are the suggestions you want to give for this tool?

Above survey has created and received some Feedbacks which included in the future development plans and some feedbacks has to come.

V. Conclusion

In This paper, Analysis has made to understand what the missing points in the business life, how A3 can improve for the companies’ usage and which problems should be focused to increase the biggest problematic areas. As a result, we have created a prototype of a digital tool according to the needs which is digitalised by using VBA excel. It contains lean tools i.e. Fishbone analysis, Pareto analysis, Value stream Mapping, 5 whys, waste management analysis and benefit Matrix, etc which has been digitalised to process it easily and to increase the efficiency of the process. After making the prototype the tool is testing with the companies and this phase is in process for collecting feedback.

Digital A3 allows company to do all the analysis by using tools like Fishbone diagram, Pareto analysis etc in one workspace by respective digital tools and allows company to increase process efficiency and reduce time and defects which can occur in manual working. This tool restricts the company’s behaviour of lengthening the process of analysing and it allows them to have a look on each step of A3 in one platform. It also helps the management to understand the each and every process and employee’s mindset to achieve the close deadlines, track their work, look overview of all A3 projects, evaluate all A3 projects in terms of efficiency with respect to time and cost. It improves the communication between the employees and pushes them to work together within the deadline. Also, Digital A3 gave the opportunity to understand the new things which can be put in original digital A3 which companies are facing in their regular work. It gave the opportunity to take the feedback from the companies in the testing face and managed to implement some of them due to ease of the tool and easy process of making changes. In the end, would like to give some suggestions for the future development of Digital A3. The prototype is designed with all details in the scope of this paper. Also, the business canvas model can be performed before selling the Digital A3 to the companies or consultancies. It can be useful to evaluate the general sales and marketing model for companies since business canvas provides cost and revenue streams, customer segments and channels, partners, resources and value proposition at the same analysis. Moreover, the last suggestion is to create premium and standard version of the Digital A3 to sell it to the different customer groups with different features.

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Seaweeds And Its Health Benefits

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Abstract- Seaweeds are considered to be sea vegetables. Mostly weeds are unwanted plants which are not consumed by humans. In this article the author describes the uses and health benefits of seaweeds to be use in mere future. Seaweeds contain vitamins, minerals, fibre, Antioxidants, and various biochemical compounds. Several studies have shown that seaweeds consumption has lowered certain life threatening diseases.

Index Terms- Seaweeds, Antioxidants, Culinary uses, Health benefits

I. INTRODUCTION

Marine micro algae or seaweeds are plant like organism that generally live attached to the rock is other hard substrate in coastal areas (www.seaweeds.com). Seaweeds along rocky shore lines around the world, but it most commonly eaten in Asian countries such as Japan, Korea and China (Sharon 2018). In particular, sea weeds harvested in the autumn contains high levels of easily extractable Laminaria and Mannitol (Horn,2000).

Although extensive marine algal collections have been made since the eighteenth century from India and Indian ocean region, iyengar (1927) was the phyecologist to publish the marine algal flora of the Indian coast (Bhavanath et al, 2009).

Edible seaweed is a vegetable of the sea, a food source for ocean life and humans who consume it in its many forms. Nutritionally speaking, seaweed has the unique ability to absorb concentrated amounts of iodine from the ocean which a human body cannot produce by itself, but requires for healthy thyroid functions. Seaweed is also an excellent source of micronutrients including folate, calcium, magnesium, zinc, iron and selenium (www.guide.michelin.com).

Seaweed research has been carried out for more than seven decades by many research workers. Research has been done separately in different aspects accordingly to our need. The main objective of the present review is to gather information relating to nutritional, pharmacological, clinical, biochemical, industrial uses and its application to human welfare.

Seaweeds have a high concentration of essential vitamins, trace elements, proteins, lipids, polysaccharides, enzymes, and minerals as compared to terrestrial foodstuffs. These plants have been a source of food, fodder, medicine, cosmetics, energy, fertilizer and are used for industrial production of agar and alginate. Their recent utilization increases in poultry due to their nutritive value. In the present scenario, it is being used for wastewater treatment such as treatment of wastewater to reduce nitrogen and phosphorus containing compounds (Mitali et al., 2016).

II. TYPES

Macro algae are classified in to three major groups. One brown algae (phaeophycae). Second green algae chorophyta and red algae rhodophytae.as all of the groups contain chlorophyll granules, their characteristics colour are derived from other pigments. Many of the brown algae are referred to simply as kelp (www.americanscientist.org).

The red seaweeds are more diverse with more than thousand species, followed by brown and green sea weeds with 2030 and 600 marine species, respectively although the brown algal thalli are largest (Joel Flurence and Ira Levine, 2016).

III. HEALTH BENEFITS

Seaweeds contain minerals, vitamins soluble dietary fibres and flavonoids. Which are regarding as preventive agents against life style related diseases. Sea weeds are consumed commonly in East Asian countries including Japan, thus intake of seaweeds might contribute to Japanese. Longevity via prevention of life style related diseases. (Utakomurai et al., 2020).

Plants avail themselves of a class of water soluble polysaccharides called pectin which are often used to help set jams and jellies ,seaweeds on the other hand contain polysaccharides that are unique to them mainly alginites carrageenan and agars which are all soluble dietary fibres (Ole G.Mouritesen,2013).

The inclusion of large amounts of seaweeds in a balanced diet has been connected to decreased the rates of many of the “western life style” diseases example (cancer and cardiac vascular diseases). Reduced rates of breast cancer in post-menopausal Japanese woman are thought to be connected to the ingestion of seaweeds in general and the kelp kombu and wakame in particular.

Seaweeds are the only source of phytochemicals namely agar agar carrageenan and align which are extensively used in various indurates such as food confectionary textiles pharmaceticals diary and paper industries. Mostly as jelling stabilizing and thickening agents. (Joel Flurence and Ira Levine, 2016).

Against Asthma
Data reviewing the 2013–2016 Korea National Health and Nutrition Examination Survey (KNHANES) discovered that lower intakes of seaweed and seafood were associated with higher rates of asthma. Because asthma is an inflammatory disease, it’s hypothesized that the polyunsaturated fats and vitamins found in these foods are protective. Although more research is needed to confirm a cause and effect benefit, introducing seaweed during pregnancy and early childhood appears to be beneficial.

Reduces Risk of Osteoporosis

Oxidation from free radicals is associated with a host of health issues, including the weakening of bones. Seaweed contains antioxidant compounds, called fucoids, which are shown to prevent bone breakdown by free radicals. Specifically, fucoids protect osteoblasts (the cells responsible for building bone) against apoptosis, or cell death, which may otherwise be induced by oxidative stress. Seaweed also provides vitamin K and calcium, two key nutrients for bone strength.

May Aid Cancer Prevention

The fucoids in seaweed have also been studied for cancer prevention. While human clinical trials are limited, fucoidan’s ability to influence programmed cell death shows promise as a potential supplement to traditional cancer treatments. Like other vegetables, seaweed is also a source of antioxidants (like vitamin C and beta carotene). These compounds are known for cancer prevention qualities, especially when consumed as part of a nutrient-dense eating plan (rather than just supplementation).

Promotes Heart Health

Seaweed is a good source of soluble fiber, especially dulse seaweed and kombu which provide 5 to 6 grams per serving. Soluble fiber binds to cholesterol, pulling it out of the body through waste. In addition to reducing cholesterol, seaweed can also help lower blood pressure levels due to its potassium content (just watch out for added sodium).[2](https://www.verywellfit.com/seaweeds-health-claims-2223487)

IV. CULINARY USES

Edible algae are those that can be eaten directly or used in the preparation of other foods as jellying or emulsifying agents ([Lenonel Perara, 2016](http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10791)). Common seaweed products

1. Agar Agar
2. Agaroids
3. Algin

Agar Agar

As a gel forming substance. Soluble in hot water and requiring one percent solution to set as gel on cooling

1. Agaroids

The gels like extracts produced from certain types of red seaweeds are commonly known as agaroids.

2. Algin

Align is a main polysaccharides occurring in the cell walls of brown algae ([Chenhubhotla et al., 1987](http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10791)).

Various red and brown seaweeds are used to produce three hydrocolloids: agar, alginate and carrageenan. A hydrocolloid is a non-crystalline substance with very large molecules and which dissolves in water to give a thickened (viscous) solution. Alginate, agar and carrageenan are water-soluble carbohydrates that are used to thicken (increase the viscosity of) aqueous solutions, to form gels (jellies) of varying degrees of firmness, to form water-soluble films, and to stabilize some products, such as ice cream (they inhibit the formation of large ice crystals so that the ice cream can retain a smooth texture). ([www.fao.org](http://www.fao.org))

Food additives made from seaweeds are mainly polysaccharides, long-chained molecules that are extracted from brown and red algae. These falls into three families: agars and carrageenans from red algae, and alginites from brown algae. Their usefulness lies mainly in their ability to emulsify, stabilise and thicken, but that they come from a natural source is, these days, a major advantage. Humans do not seem to have the ability to break them down, so they can be very useful in low-fat foods. Some coralline algae are now used as natural sources of calcium and magnesium sulphate. Alginate beads, dyed with natural colours (below) and with added fish oils, have been used as fish-egg substitutes ([https://seaweed.ie/additives/index.php](https://seaweed.ie/additives/index.php)).

Seaweeds are used in many maritime countries as a source of food. The present uses of seaweeds are as human foods, cosmetics, fertilisers, and for the extraction of industrial gums and chemicals. They have the potential to be used as a source of long-and short-chain chemicals with medicinal and industrial uses. Marine algae may also be used as energy collectors and substances may be extracted by fermentation and pyrolysis ([www.niobioinformatics.com](http://www.niobioinformatics.com)).

V. SEAWEED ANTIOXIDANT

A study published in the Journal of Food Science shows that seaweed may be a good source of macromolecular antioxidants. Seaweeds are rich in different bioactive compounds with potential uses in drugs, cosmetics, and the food industry. In this study, researchers wanted to analyze macromolecular antioxidants or non-extractable polyphenols in several edible seaweed species collected in Chile.

Macromolecular antioxidants, commonly ignored in studies of bioactive compounds, are associated with insoluble dietary fiber and exhibit significant biological activity, with specific features that are different from those of both dietary fiber and extractable polyphenols.

The researchers also evaluated extractable polyphenols and dietary fiber, given their relationship with macromolecular antioxidants. They found that that macromolecular antioxidants are a major polyphenol fraction (averaging 42% of total polyphenol content), with hydroxycinnamic acids, hydroxybenzoic acids, and flavonols being the main constituents. This fraction also showed remarkable antioxidant capacity, as determined by two complementary assays. The dietary fiber content was more than 50% of dry weight, with some samples exhibiting the target...
proportionality between soluble and insoluble dietary fiber for adequate nutrition. The researchers concluded that “Given the nutritional interest of these compounds, the consumption of these seaweeds might be promoted within the frame of a healthy diet and they can also be used as sources of macromolecular antioxidants and dietary fiber for the production of new ingredients.” (www.ift.org)

Algotherapy is a science in which, seaweed extracts are used in health or beauty treatments. Seaweed baths were a widespread feature of seaside resorts at the end of the 19th and beginning of 20th century in several southern and western locations. Seaweed baths as a treatment for arthritis, rheumatism and other aches and pains. Many companies producing a seaweed powder (made mainly from Medicinal and pharmacological properties Ascophyllum nodosum) for beauty and body care products containing seaweed extracts. A number of compounds extracted from seaweeds are thought to be of value in various cosmetic applications and some are now becoming commercially important. (Sharma et al., 2000)

VI. CONCLUSION

Seaweeds which are considered to be the most needed powerful plants of the ocean not only serve as a vegetable but at the same time it is believed to be highly beneficially in curing certain life style diseases and disorder of humans. The author of the article brings the need of using seaweeds in various culinary and pharmaceutical preparations to lead a healthy life

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Socio-Economic Conditions Of Differently-Abled Persons In India – An Empirical Study Based On Secondary Data.

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Abstract- In developed countries, the proportion of people with disabilities ranges from 10 per cent to 20 per cent of total population. Prevalence of disability in developing countries is reported to be 1 per cent to 2 per cent of the population. Persons with disabilities are considered as the world’s largest minority. They are more likely to live in poverty than their non-disabled peers; hence a small portion of governmental allocation will not be sufficient to improve the social and economic conditions of differently abled people. The capacity building and overall development of differently abled persons on par with their non-disabled counterparts and their social inclusion in all developmental activities should be ensured. Persons living with disabilities face multiple barriers due to injustice on the basis of race, colour, sex, language, religion, political opinion, national, ethnic, indigenous or social origin, property, birth and age. As a result, persons with disabilities are at a high risk of poverty, which in itself increases the likelihood of having a disability. Social exclusion and inclusive growth have opened up serious debates and discussions on the role of different factors in the development discourse across the globe. In India certain sections of the society are away from the mainstream society and are considered as the most vulnerable groups or outer class. They are often denied minimum access to the basic needs. In India social exclusion is stratified on the basis of caste, class and gender. Differently abled people are excluded from the process of advanced human existence and development (Kummitha, 2015). In addition to social exclusion, problems such as, poverty, unemployment and gender discrimination continue to affect the social and economic development of most of the marginalised groups in India.

Index Terms- Differently-Abled, Poverty

I. INTRODUCTION

Disability is a part of the human state. Almost everyone will be temporarily or permanently impaired at some point in life by poverty, malnutrition, birth disorders, accidents, old age, psychological disorders, natural calamities and wars, those who survive to old age will experience increasing difficulties in functioning and living. Most families have a disabled member, and many non-disabled people take responsibility for supporting and caring for their relatives and friends with disabilities (World Report on Disability). One third of families in India are directly or indirectly affected with some sort of disability. Disability and political issues related with disability become more acute due to population growth, increasing number of accidents and increasing number of old age people. The main issue related with disability is the social exclusion of the disabled. The concept and attitude of society towards disability have changed since the 1970’s. There is a growing tendency to view disability as a human right issue than a social issue. Once, people with disabilities were relegated to special schools and residential institutions. Now the change is visible from community exclusion to the best integrated social inclusion and community participation. The approach to disability has now shifted from social exclusion to social inclusion through educational and vocational training.

Development in the field of modern medicine and medically focused solutions to overcome the conditions of disability have given way to more interactive approaches recognizing that people are disabled by environmental factors. National and international initiatives such as the United Nations Standard Rules on the Equalisation of opportunities of Persons with Disabilities - have incorporated the human rights of people with disabilities. Disability is now considered as a human right issue rather than physical problem. The adoption of The United Nations Convention on the Rights of Persons with Disabilities, (UNCRPD) is an International level agreement to protect the rights of differently abled people among the member countries.

1.2 Background of the Study

Economists, Sociologists and Philosophers have always lived among people who could see, walk, or hear; little attempt was made to study about those, who had limited mobility, deformity, or chronic illnesses of various classes of people in the society. Philosophical interest in these conditions was piecemeal and occasional until the past hundred or so years (Alman, B., 2001). But the treatment of disability as a subject of philosophical interest is relatively new. Economists have no such concepts to discuss development related with socially marginalized groups, except inclusive development. Sociologists in general have been thinking of social development without economic development of socially excluded groups. The lack of attention to socially marginalized groups, especially “Specially Abled” in general may have an explanation: there were no such concepts to attend to until
19th century. Once such categories were established, it became possible to talk, and generalize, about the specially abled (Hacking, 1990; Davis, 2002,). The resurgent political philosophy of the second half of the last century, preoccupied with eliminating or reducing unearned disadvantages, tended to treat disability as a primary source of those disadvantages to be addressed with government compensation (G. L. Albrecht, K.D. Seelman, and M. Bury, Thousand Oaks, 2001). Sociologists began to see disability as a source both of discrimination and oppression.

1.3 Statement of the Problem

People with disabilities are generally considered as social evil in the society. Disability is a part of human condition in some stages of ordinary human life due to accidents, diseases, natural calamities, wars or aging. Disability is considered as a human right issue and a social evil. The disability experience results from various factors such as poor health conditions, poverty, personal factors and environmental conditions. Disability is a complex, multidimensional and dynamic problem due to social and environmental barriers.

Disability is neither a purely medical problem nor a purely social problem. Persons with disabilities are diverse and heterogeneous. The concept and reading of disability varies according to the intention and views. Disability is a dynamic interaction between health conditions and environmental factors. Disability is the umbrella term covering impairment, activity limitation and participation restriction with the interaction between an individual with his environment.

The models of disability, the concepts and views are different. According to World Health Organisation's International Classification of Functioning, Disability and Health (ICF, 2001), Disability is a “dynamic interaction between health conditions and environmental and personal factors”. Modern political economists have been trying to attend to the problems of the differently abled community. Differently abled persons are the world’s largest minority and measures to eliminate disability conditions by way of changes in social mind, vaccination, and malnutrition are taken.

1.4 Significance of the Study

People who could not see, walk, or hear, who had limited mobility, comprehension or longevity, or chronic illnesses of various sorts are generally considered as differently abled. These conditions were cited in ancient philosophical and moral literatures of different cultures. Hardships or evils of those people who are disabled came into the debates of ancient philosophers, and they inquired the reasons and cause of disability and tried to find out the relationship between disability and philosophical, psychological and social relations. In ancient times disability was considered as a social evil and the society treated them as a social and cultural problem. The treatment of disability as a subject of philosophical social interest is a relatively new area of study.

The lack of awareness on “disability” or “impairment” lasted till the first half of twenty first century. Generally many had a simple reason: that there were no such concepts to focus on human function. Categories of abnormality and disability were established only in the late 19th century. Modern philosophers have contributed more to revolutionize the social concepts and approaches about the disabled. Modern political economists have been trying to address the problems of differently abled people, when they became the world’s largest minority. Social and political philosophy of the second half of the 21st century, considered ways to eliminate or reducing disability conditions by way of changes in social mind, vaccination, poverty eradication, health care and malnutrition. To address the issues in medical, governmental, and social concepts of disability, many theories have been developed in the field of the socially marginalised. Social philosophers identified disability as a condition due to discrimination and oppression by the societal culture. In the modern world, it became possible to talk, and generalize, and recognize the problems and issues of disabled by analysing and establishing disability statistics. This study attempts to coordinate the disability statistics in India to address the issues of the disabled.

1.5 Scope of the Study

Disability looks much like sex or race, because women are more disadvantaged than their counterpart, and face multiple discriminations. Disability classification is based on medical or socially constructed base and the disability classification based on right would address the central issues on disability. Well-being of a disabled body is affected by the inherent characteristics on the classification of disability. A world without discrimination, blacks or whites, men or women, abled or disabled would do better on various metrics of social standards in the modern world. Philosophers and disability scholars say that there are no differences in race or sex to the degree that disability reduces well-being; it is because of the disgrace and prejudice. Disability is fundamentally different from race and gender discrimination in that it necessarily reduces well-being even in a world of non-discrimination, people with blindness, deafness or physically handicapped and mental disability would be worse off than their able-bodied counterparts. Many theories have been developed relating to the socially disadvantaged. Social philosophers identified disability as a condition due to discrimination and oppression by the society. The scope of the study is limited to analysing and evaluating the disability statistics in India.

1.6 Objective of the Study

1. To study the Socio–Economic background of differently abled persons in India.

1.6.1 Data Sources

Entrepreneurial Development Indices, earlier research studies and personal records constitute the secondary source of data. Data are collected from Governmental and non-governmental organisations, disability studies conducted in related fields. Census Data published by the Department of Census and National Sample Survey Organisation are used for the study and other published and non-published sources. Disability reports of Japan International Cooperative Agency, World Bank Report published by department of Social Protection and Labor and Human Development Unit South Asia Region, World Report on Disability, India Health report and United Nations Convention on the Right of Persons with Disabilities.

1.6.2 Study Design

The present study is an empirical study based on secondary data. The purpose of the study is to gauge incidence of disability in India. Data were collected from secondary sources and the study
is based on sound methodology. The descriptive statistical analysis helps to establish very clear differential characteristics of variables related to the study. The study design, plan, structure and strategy of the study are descriptive. The study is purely empirical in nature.

1.7 Socio-Economic Profile of Specially-Abled in India

In India, at the national level, information about people with disabilities and data on differently abled people are derived from censuses data, population surveys, national Sample Surveys and administrative data registries. But exact data is not available due to difference in approach and focus on disability concepts and definitions. To get accurate data on disability, disability prevalence, and socio-economic status, it is very important to take stringent measures on the part of government and other agencies to coordinate the activities under a common approach. Data by sex, age, income, and occupation about differently abled people in India provides information about subgroups of persons with disabilities, such as children with disabilities and women with disabilities and older persons.

The existing data available indicates that people with disability are subject to multiple deprivations. As compared to the general population, they suffer more from poverty, low literacy, unemployment, social exclusion and active participation which put them further behind. The differences in access to basic services and degree of social marginalisation among persons with different types of disability are also striking, and they get further marginalised and magnified, with differences on account of gender, caste, types of disability and rural/urban background etc. It is therefore, important to study the socio-economic profile of the disabled population in India. With population Census and NSSO conducted on 2001 surveys revealing different aspects of the disability scenario, the socio-economic profile of the disabled obtained from these two sources are being important for the better understanding of socio-economic conditions of disabled people in India.

1.8 Disabled Population by Sex and Residents in India

Two major official sources were adopted to estimate the total number of persons with disabilities in India. The census data and National Sample Survey estimates, the estimates of these two official sources show that the number of PWD is increasing due to increase in the number of accidents, calamities, malnutrition, aging and demographic transition. Two major official sources of data on disability differ, with the differences appearing in approaches and definition.

Table 1.1: Disabled Population by Sex and Residents in India
Census 2011 (in Millions)

<table>
<thead>
<tr>
<th>RESIDENTS</th>
<th>PERSONS</th>
<th>MALES</th>
<th>FEMALES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>26.8</td>
<td>18.6</td>
<td>8.2</td>
</tr>
<tr>
<td>RURAL</td>
<td>15.0</td>
<td>10.4</td>
<td>4.6</td>
</tr>
<tr>
<td>URBAN</td>
<td>11.8</td>
<td>8.2</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Source: Census data- 2011.

According to census – 2011 data, the total number of disabled population in India was 26.8 million. The table (1.1) shows that out of the total disabled population, 18.6 million are males and 8.2 million females. 15.0 million Disabled people live in rural areas and the urban residents constitute 11.8 million. Out of the total disabled population 10.4 million differently abled persons are rural males and 8.2 million persons are urban males. 4.6 million Disabled females live in rural areas and 3.6 million in urban areas.

### Table 1.2: Proportion of Disabled Population by Residence

<table>
<thead>
<tr>
<th>RESIDENTS</th>
<th>PERSONS (2001)</th>
<th>PERSONS (2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>2.13</td>
<td>2.21</td>
</tr>
<tr>
<td>RURAL</td>
<td>2.21</td>
<td>2.24</td>
</tr>
<tr>
<td>URBAN</td>
<td>1.93</td>
<td>2.17</td>
</tr>
</tbody>
</table>

Source: Census of India – 2001 and 2011.

The table (1.2) shows the proportion of disabled population by area of residence in two census periods. The proportion of total disabled population in 2001 was 2.13 percent and 2.21 percent during the period 2011. The decadal growth shows an increasing trend within a period of ten years in the proportion of disabled population by residence. Prevalence of disability is higher in urban areas than rural areas.

### Figure 1.1: Proportion of Disabled Population by Residence in India 2001 – 2011.

Source: Census of India 2001 and 2011.

Percentage of disabled persons in India has increased both in rural and urban areas during the last ten years. Proportion of disabled population is higher in rural areas than in urban areas. Decadal increase in the proportion is significant in urban areas than in rural areas. Urban India faces a number of problems such as demographic transition, pollution, increased number of accidents, population density etc. These contribute to incidence of disability in urban India.
1.9 Disabled Population by Type of Disability

In India, disability prevalence is very high, and people with disabilities experience discrimination in accessing education, employment, health care, social recognition, and transportation. They suffer more from poverty, low literacy, unemployment, social exclusion, and lack of active participation; which put them further behind. The differences in access to basic services and degree of social marginalisation among persons with different types of disability are also striking, and they become marginalised and magnified with differences on account of type of disability and severity of disability conditions.

### Table 1.3: Proportion of Disabled Population by Type of Disability

<table>
<thead>
<tr>
<th>Type of Disability</th>
<th>Persons</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Seeing</td>
<td>18.8</td>
<td>17.6</td>
<td>20.2</td>
</tr>
<tr>
<td>Hearing</td>
<td>18.9</td>
<td>17.9</td>
<td>20.2</td>
</tr>
<tr>
<td>Speech</td>
<td>7.5</td>
<td>7.5</td>
<td>7.4</td>
</tr>
<tr>
<td>Locomotors</td>
<td>20.3</td>
<td>22.5</td>
<td>17.5</td>
</tr>
<tr>
<td>Mental retardation</td>
<td>5.6</td>
<td>5.8</td>
<td>5.4</td>
</tr>
<tr>
<td>Mental Illness</td>
<td>2.7</td>
<td>2.8</td>
<td>2.6</td>
</tr>
<tr>
<td>Multiple disability</td>
<td>7.9</td>
<td>7.8</td>
<td>8.1</td>
</tr>
<tr>
<td>Other type of Disability</td>
<td>18.4</td>
<td>18.2</td>
<td>18.6</td>
</tr>
</tbody>
</table>

Source: C- Series, Table C-20, Census of India 2011.

1.10 Disabled Population by Various groups and Types

Disability prevalence among various groups is very important to take stringent measures on the part of government and other agencies to coordinate the activities under a common approach. Data by sex, residents, marginalised groups of SCs and STs in India provides information about subgroups of persons with disabilities. Most vulnerable groups are children and women with disabilities and older persons.

### Table 1.4: Disability Prevalence of Various Groups & Types (Percentage)

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scheduled castes</td>
<td>2.68</td>
<td>2.2</td>
<td>2.45</td>
</tr>
<tr>
<td>Scheduled Tribes</td>
<td>2.18</td>
<td>1.92</td>
<td>2.05</td>
</tr>
<tr>
<td>Rural</td>
<td>2.43</td>
<td>2.03</td>
<td>2.24</td>
</tr>
<tr>
<td>Urban</td>
<td>2.34</td>
<td>1.98</td>
<td>2.17</td>
</tr>
<tr>
<td>Total</td>
<td>2.40</td>
<td>2.01</td>
<td>2.21</td>
</tr>
</tbody>
</table>

Source: Census of India 2011.

As per Census (2011) findings, differently abled persons are grouped on the basis of the nature of disability. About 18.8% had vision disability, 7.5% had speech disability and 18.9% were suffering from hearing disability, 20.3% had locomotor disability, 5.6% had mental retardation, 2.7% of them were facing mental illness, 7.9% of people had multiple disability and remaining 18.4% of the people were accounted under disability by unknown reasons. The proportions vary marginally across different types of disability.

In the rural areas, the distribution of disabled across social groups was found to be more or less the same. In rural India, the prevalence of disability was much higher (2.24%) as compared to that in its urban counterpart (2.17%). Again, among males, the prevalence of disability (2.4%) was significantly higher than that in females (2.01%).

**Figure 1.2: Disabled Population by Type of Disability (Percentage)**

**Source: Census of India 2011.**
among females (2.01%). The prevalence rate among SC population (2.45%) was marginally higher when compared to the general population; while among ST population, it was noticeably lower (2.05%). Among the disabled persons belonging to STs, the proportion of persons with visual, speech and hearing disability was relatively more and those with loco motor or mental disability was relatively less as compared to the general population. On the other hand among disabled persons belonging to the SC category, these proportions were more or less same as those among the general population.

1.11 Disabled Population by Type of Disability

The existing data indicate that the people with disability are subject to multiple deprivations. As compared to the general population, they suffer from poverty, low literacy, unemployment, social exclusion and limited participation. Multiple deprivations lead to poverty and social exclusion; the differences in access to basic services and degree of social marginalisation among persons with different types of disability are also striking, and their life become more and more susceptible and overblown. Due to differences on account of gender, caste, types of disability and rural and urban divide are increasing the intensity of vulnerability.

### Table 1.5: Disabled Workers by Type of Disability (Millions)

<table>
<thead>
<tr>
<th>Type of Disability</th>
<th>Persons</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>9.7</td>
<td>7.1</td>
<td>2.7</td>
</tr>
<tr>
<td>Seeing</td>
<td>1.9</td>
<td>1.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Hearing</td>
<td>2.1</td>
<td>1.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Speech</td>
<td>0.8</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Locomotors</td>
<td>2.0</td>
<td>1.6</td>
<td>0.4</td>
</tr>
<tr>
<td>Mental retardation</td>
<td>0.3</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Mental Illness</td>
<td>0.2</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Others</td>
<td>2.0</td>
<td>1.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Multiple Disability</td>
<td>0.4</td>
<td>0.3</td>
<td>0.1</td>
</tr>
</tbody>
</table>


Table (1.5) shows the number of disabled workers by type of disability. Out of the total 26.8 million disabled population in India 9.7 million disabled persons are workers. 1.9 million Disabled workers suffer from disability in vision. People with hearing disability have the highest work participation (2.1 million) among total number of disabled in India. Least work participation is found among people suffering from mental retardation.

1.12 Disabled Population by Type of Disability (Census and NSS estimates)

Population Census and National Sample Survey Organisation surveys conducted on 2001 revealed the different aspects of the disability scenario, the socio- economic profile of the disabled. The data obtained from these two sources are being important for the better understanding of socio, economic conditions of disabled people in India. These two major official sources are acceptable to estimate the total number of persons with disabilities in India. The census data and National Sample Survey estimates, estimates of these two official sources were showing that the number of PWD is increasing. The number of disabled people in India is increasing due to the increasing number of accidents, calamities, malnutrition and aging and demographic transition.
in the age group of 0-9 years and thereafter as age increased the number of persons with disability decreased gradually for both males and females. More than 7.5 million persons with disability were in the age group of less than 30 years, (35%). 15% of persons with disability were between 20 to 30 years of age. Less than 20% of disabled males and females were more than 50 years of age. Majority of disabled persons in India were reported to be very young. Higher rate of prevalence of disability were reported in the age group below 30 years, accounting for 35% of the total disabled population. The reasons for the higher rates of disability were due to malnutrition, low birth weight, lack of care and poverty. The highest numbers of disabled persons were reported to be in the age group of 20 to 30. Rate of disability was low in old age when compared to other age groups.

1.14 Disability Prevalent in Major States in India

The onset of disability experience as a result from the interaction of health conditions, personal factors, environmental factors, social perceptions varies greatly. Persons with disabilities are diverse and heterogeneous; many people with disabilities do not consider themselves to be unhealthy. Generalisations about “disability” and “persons with disabilities” can mislead. Persons with disabilities have diverse personal factors with difference in gender, age, socio-economic status, sexuality, ethnicity or cultural heritage. Disability correlates with disadvantages, or limitations. Not all people with disabilities are equally disadvantaged. Women and children with disabilities are more disadvantaged. They are disadvantaged in terms of economic, social and combined disadvantages associated with gender discriminations.

A person’s environment has a huge impact on the creation, experience and extent of disability. In accessible environment create disability by creating barriers to social participation and social inclusion. Health is affected by environmental factors, such as safe water, air, food, nutrition, poverty, working environment, climate, geographical conditions, and access to health care and infrastructural facilities above all the political, social and economic conditions prevailing in the environment. Political instability and wars, social security measures and social perception, ethical and religious believes, economic culture and structure and economic philosophy of the environment are all having huge impact for the creation and prevention of disability and disability impacts.
1.15 Conclusion

Disability is a development issue, because of its multi-dimensional link to poverty; disability may increase the risk of poverty; and poverty may increase the risk of disability (Sen-2009). People with disabilities and their families are more likely to experience the economic and social disadvantage than non-disabled people and families. The multi-dimensional impact of disability is adversely affecting and worsening the social and economic wellbeing of disabled people. Poverty through multitude of channels have an adverse impact on education, employment, social participation, access to health care, livelihood, earnings and also increases the expenditures related to poverty and disability.

1.16 Findings

1. Definition of disability often varies across countries, disciplines, organisations and different programmes for disability.
2. The society and the environment create barriers for disabled people in-terms of social inclusion and activity participation.
3. Children with disabilities are less likely to attend schools, because of increasing number of school drop-outs and poverty, thus experiencing limited opportunities for Human Capital formation and face reduced employment opportunities and decreased productivity in adulthood.
4. People with disabilities are more likely to be unemployed and generally earn less even when employed in both genders. The nature and severity of the disability appear to adversely affect both income and employment opportunity.
5. People with disabilities are not benefited from development programmes in the full sense and it is difficult to escape from poverty due to discrimination and social exclusion.
6. Social discrimination limits active participation, employment opportunities, access to transportation, access to resources to promote self-employment and livelihood activities.
7. People with disabilities have extra costs resulting from disability, such as costs for medical care, assistive devices, the need for personal care support and assistance, and need more resources to achieve same outcomes as non-disabled people. This is what Amartya Sen called “Conversion Handicapped”.
8. Families with disabled member are more likely to experience acute poverty, insecurity in life, poor housing facilities, and inadequate access to health care and are also denied safe water and better sanitation.
9. People with disabilities are subject to violation of dignity and social recognition. Some people with disabilities are denied autonomy, in education, travel, and social recognition.
10. It is noted with due concern that majority of the disabled persons in India were reported to be very young. Disability and poverty are dynamic complex phenomena in every country.
11. Disability leads to poverty and vice versa. Disability may increase the risk of poverty and poverty may increase the risk of disability.
12. Social exclusion and marginalisation of disabled people from the society have been noted. There is a two way causation between disability and poverty.
13. Disabled population in India is affected by lower educational attainment with lower living standards. Employment rates among disabled people are much lower than among other social groups.
14. Due to cultural differences, social exclusion, environmental barriers and low educational attainment. Poverty rates among disabled households are considerable higher than the average poverty rates in rural areas nationally.

Figure 1.7: Disability Prevalent in Major States in India (Percentages)
15. There is very high rate of widowhood among women with disabilities than among non-disabled women consequently higher probabilities of being poor.
16. Households with disabled member tend to be poorer and more vulnerable.
17. The prevalence of disability was found to be more in rural areas (2.2%) as compared to urban areas (1.9%); and more among males (2.4%) than among females (1.9%).
18. Among social groups, higher incidence of disability was observed among Scheduled Castes (2.2%) and relatively lower incidence among Scheduled Tribes (1.9%) as compared to others.
19. Disabled population in different age-groups according to Census 2001 revealed that in general, the number of disabled persons increased with age, broadly in the age group of 0-19 years; and thereafter as age increased, the number of PWD decreased gradually for both males and females.
20. More than 35% of the disabled persons (more than 7.5 million in number) were less than 20 years of age and another 15% were between 20 to 30 years of age. Less than 20% of disabled males and females belonged to the age more than 50 years.
21. In India, more than 98% of the disabled persons live in normal households, while only 1.1% were in institutional households and remaining 0.2% were homeless.
22. Out of the 193 million households in India, a little less than 10% households reported to have one or more disabled members.
23. 17% of institutional households and 8% of homeless households had disabled member(s).

REFERENCES

AUTHORS
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Third Author – Indurajani.R, Assistant Professor, Government College Nedumangad, University Of Kerala, Thiruvananthapuram, Kerala,
Structural Equation Model Of Entrepreneurship Development - A Study Based On Entrepreneurial Traits Of Differently Abled Persons In India


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Abstract- Entrepreneurship is the process of starting a business organization. The entrepreneur develops a business model and acquires the human capital and other resources, and is fully responsible for its success or failure. Entrepreneurship operates within an entrepreneurship ecosystem. The term entrepreneurship was first used in the year 1723. Today the term entrepreneur implies a person with many qualities such as leadership, initiative, management, decision making and innovation. Entrepreneurs contribute to the development of the society and generate employment opportunities. According to Robert Reich, team building, leadership, and management abilities are essential qualities of an entrepreneur. An entrepreneur is a factor unit in micro economics, and the study of entrepreneurship dates back to the works in the late 17th and early 18th centuries. In the early periods, Richard Cantillon and Adam Smith were the pioneers in entrepreneurship studies. Entrepreneurship can be considered as a tool for the employment of educated unemployed. Entrepreneurship helps to increase national income and bring about social change. Entrepreneur contributes to a movement towards economic equilibrium by pursuing opportunities (Kirzner, 1973). In India unemployment among differently-abled people is considered as a social and economic problem and entrepreneurship is seen as a mechanism to solve that problem.

Index Terms- Entrepreneur, Entrepreneurship etc...

I. INTRODUCTION

The word “entrepreneurs” immediately conjures rich, famous and successful business individuals. Entrepreneurs are recognized as the key to economic growth in the world. They are entrepreneurial in terms of self-development, self-decision making, self-esteem of creativity and risk taking. Thus, anyone who exhibits creativity and risk taking can be considered as an individual with entrepreneurial qualities. When these qualities are exhibited by a person he can be called an entrepreneur.

Entrepreneurs initiate and create change in the formation of business and society. This change is accompanied by growth and productivity, which allows more wealth to be distributed among various sections in the society. Thus, entrepreneurship leads to increase in the national income of the country and enhance economic development. Entrepreneurship can be looked upon as a means of income generation and economic development.

II. BACKGROUND OF THE STUDY

Entrepreneurs identify new opportunities and observe profitable opportunities, the core of entrepreneurship being alertness. Entrepreneur decides his social status and controls his life. So it is widely believed that this entrepreneurial function is a vital component in the process of economic growth (Baumol, 1968, Casson,1982 & Hornady, 1990). Entrepreneurship is defined in a different way by different authors. Entrepreneurship is a risk bearing activity, entrepreneurship is an innovative process, and entrepreneurship is a thrill seeking activity. Entrepreneurship is an attempt to create value and it is an act of being an entrepreneur, thus the notion of entrepreneur is diverse according to different thinkers. Therefore entrepreneur is a person who initiates entrepreneurial activities, and coordinates the entrepreneurial function. In industrialised nations, entrepreneurship has been a key to economic growth in productivity and per capita income (Baumol, 1986, Hamilton and Harper, 1994).

In mid 20th century, entrepreneurship was studied by Joseph Schumpeter and other Austrian economists Carl Menger, Ludwig von Mises and Friedrich von Hayek. The term "entrepreneurship" was invented around the 1920s, while French word entrepreneur dates to the 1850s. In the beginning, economists made the first attempt to study the concept of entrepreneurship in depth. Richard Cantillon (1710) considered the entrepreneur to be a risk taker who deliberately allocates resources to take advantage of opportunities in order to exploit the economic return. Cantillon highlighted the willingness of the entrepreneur to assume anticipated risk and to combat with uncertainty. Thus, he describes the function of the entrepreneur, and distinguishes clearly between the function of the
entrepreneur and the owner who provides the money. Alfred Marshall viewed the entrepreneur as a multi-tasking capitalist and observed as an economic activity creator.

III. SIGNIFICANCE OF THE STUDY

Since the mid-seventies slogan such as the no-growth economy, the deindustrialisation and the Kondratieff stagnation of the economy have become popular and consequently a profound shift from a managerial economy to an entrepreneurial economy occurred. In the United States, the entrepreneur is one who starts his own new and small business. The growth and development of all economies are highly dependent on entrepreneurial development. Entrepreneurs provide a source of income, produce new and value added products, drive value chain activities, support environment protection and overall they are the essence of economic growth.

In India, the evolution of entrepreneurship can be traced back to centuries in the forms of artisans, craftsmen and entrepreneurial people in the village community. The caste based workers such as farmers, artisans, priests were considered as compact system of village community. Manufacturing entrepreneurship in India emerged as talented forms in the periods of Royal ruling. West Bengal enjoyed the world wide popularity for corah, Lucknow for chintzes, Ahmedabad for dupattas and dhoolis, Nagpur for silk, Kashmir for shawls, Banaras for metal, and Kannepuram for golden silks and Kerala for spices.

IV. STATEMENT OF THE PROBLEM

Entrepreneur does things differently rather than doing what is already done better. It is commonly believed that entrepreneurship is enormously risky, because area of innovations the casualty rate is very high and the chance of success or survival seems to be quite low. Theoretically, entrepreneurship should be the least risky rather than the most risky course. Inclusive growth is an agenda all over the world. Social exclusion results in potential degradation of human existence. Research on entrepreneurship and entrepreneurship skill development programme are organised to upgrade the conditions of vulnerable social groups. Human capital theory has been adopted as a quantitative approach to study the concepts of entrepreneurship, entrepreneurs and enterprise.

There is a lack of qualitative exploratory studies investigating the underlying phenomena and variables for the formation of an enterprise. In this study, a qualitative exploration is made of the phenomena that lie behind the formation of enterprise by the effective use of human potential of Differently abled Persons. Entrepreneurship development among Differently abled persons has not been investigated from an economic perspective before, and this study identifies the concepts and explores the entrepreneurial traits and qualities of Differently abled Persons.

V. SCOPE OF THE STUDY

Entrepreneurship has been considered as the backbone of economic growth and social development. The level of economic growth of an economy depends on the level of entrepreneurial activities in a region. Entrepreneurs can be created and nurtured through appropriate interventions in the form of entrepreneurship development programmes. In the era of liberalisation and globalisation entrepreneurs make use of the emerging opportunities. This study is meant to suggest a model of entrepreneurship development. This model is a structural equation model based on residual potentials and entrepreneurial traits of differently abled entrepreneurs.

VI. OBJECTIVE OF THE STUDY

1. To suggest a specific model of entrepreneurship development based on entrepreneurial traits and residual potential of differently abled entrepreneurs.

H0 : The hypothesized model has a good fit

Operational Definitions

Differently-Abled Entrepreneurs.

In this study, Disabled or Differently-abled Entrepreneurs are defined as, “those who have any type of functional disability by physic or psychic, starts and operate a business or service firm of their own by using owned or borrowed fund from government, non-governmental agencies or from any other agencies and actively participate in employment generation, creation of business culture, self-development and attainment of economic independency in micro and macro terms”.

Residual Potential

In this study, Residual Potential of Differently-abled entrepreneurs can be defined as, “an ability of disabled body in talented form of personal and soft skills than the abled body, not in the same intensity and capacity in each disabled body, traits of environmental adaptation, self-awareness, empathetic and sympathetic culture, communication and problem solving skills, skill for coping with emotions and interpersonal relations, creative and critical thinking, determination are attained by disability condition and the interaction of society and environment”.

Data Source

Primary Data

National Handicapped Development and Finance Corporations is a national level institution meant for the entrepreneurship development for differently abled people in India. The primary data are collected from those differently abled entrepreneurs. Those who received financial and entrepreneurial assistance are selected as sample respondents based on systematic random sampling technique.

Variables identified for the Study

Personality traits, need for achievement and locus of control are the main characteristics associated with entrepreneurial inclination (Landstrom,1998), Entrepreneurs have higher internal locus of control than other population (Rauch & Frose, 2000), free and easy access to resources enhances the individual’s ability to detect and act upon discovered opportunities (Davidson & Honing, 2003). The identification and exploration of new business opportunities mainly depends upon the internal locus of control.
Locus of Control (LoC) had negative influence on entrepreneurial inclination (Mohas, Singh & Kishore, 2007).

To understand entrepreneurs better, it is necessary to understand the entrepreneurial traits first, Self-Confidence, Optimism and positive response to challenges (Optimistic), Ability to take calculated risks (Risk Taking Capacity), Flexible and ability to adapt knowledge of markets (Knowledgeable), Ability to get along with others better (Manager), Independent Mindedness, Versatile Knowledge, power and competence, Creativity, Need to Achieve, Dynamic Leadership, Response to Suggestions, Take Initiatives, Resourceful and Persevering, Perceptive with Foresight, Responsive to Criticism are considered as the main qualities of successful entrepreneurs (John Hornday, 2000). The innate qualities of an entrepreneur lead to success. Entrepreneurial traits or qualities such as Vision- (ability to dream and ability to implement), Knowledge- (sound, conceptual knowledge about the world), Desire to succeed (strong desire to succeed in life), Independence- (Independent in work and decision making), Optimism- (optimistic in all concern), Value addition- (Desire to improve and optimization of resources), Leadership- (Became a leader in all respect), Hard-Working- (Work holistic), Risk-taking- (Ability to take calculate risks) are most integral elements and constitute the nature of an entrepreneur.

VII. STUDY DESIGN

This study is related with a Multiple Regression Analysis of Entrepreneurship Development to prove the correlation between entrepreneurship development and the factors of entrepreneurship development. Multiple regression model is used for the analysis of entrepreneurship development among differently abled entrepreneurs. Two entrepreneurship development factors are used as independent variables namely: Residual Potential and Entrepreneurial Traits. Entrepreneurship Development is taken as the dependent variable. The study design is purely an exploratory study based on primary data.

Research Instrument

An interview schedule was prepared to collect all relevant information required to achieve the research study objectives. Detailed discussions with academicians in disability studies, psychology disciplines, experts and officials in the government and non-governmental agencies were conducted. A preliminary survey among differently abled people was conducted in-order to identify the research variables to be included in the final instrument of the interview schedule. The instrument of data collection was tested through a pilot study for reliability and fixing the sample size before its actual administration.

Population of the Study

The population of the study is differently abled people with entrepreneurial talent. The sample frame of the study is mainly taken from the list of beneficiaries of the National Handicapped Finance and Development Corporation (NHFDC) for the financial year 2012-2013, those who received financial or entrepreneurial assistance from this institution directly or indirectly (from the institution or from nodal agencies). The final list of beneficiaries for the financial year 2012-2013 was taken as the population base of this study. To test the statistical significance the following hypothesis is tested.

H₀ There is no significant relationship between entrepreneurship development and the factors of entrepreneurship development among differently abled entrepreneurs.

Table 1.1: Mean and Standard deviation of Factors of Entrepreneurship Development among Differently Abled entrepreneurs

<table>
<thead>
<tr>
<th>Regression Results</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual Potential</td>
<td>2.02</td>
<td>0.728</td>
</tr>
<tr>
<td>Entrepreneurial Traits</td>
<td>1.95</td>
<td>0.736</td>
</tr>
<tr>
<td>Entrepreneurship Development</td>
<td>1.99</td>
<td>0.746</td>
</tr>
</tbody>
</table>

Source: Primary Data.

Table (1.1) shows the mean scores three main variables such as residual potential, entrepreneurial trait and entrepreneurship development. Residual potential is the most important variable with a highest mean score of 2.02, followed by entrepreneurship development 1.99 and entrepreneurial trait 1.95.

Table 1.2: Pearson Correlation Coefficient between Factors of Entrepreneurship Development among Differently Abled Entrepreneurs

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Residual Potential</th>
<th>Entrepreneurial Traits</th>
<th>Entrepreneurship Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual Potential</td>
<td>Pearson Correlation</td>
<td>1</td>
<td>0.340</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.000</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Entrepreneurial Traits</td>
<td>Pearson Correlation</td>
<td>0.340</td>
<td>1</td>
</tr>
</tbody>
</table>
Entrepreneurship Development

<table>
<thead>
<tr>
<th></th>
<th>Pearson Correlation</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entrepreneurship Development</strong></td>
<td>0.235</td>
<td>0.004</td>
</tr>
</tbody>
</table>

**N**: 150

**Source: Primary Data.**

Pearson correlation coefficient between factors of entrepreneurship development among differently abled entrepreneurs indicate that correlation coefficient between residual potential and entrepreneurship trait is 0.340, which indicates 34 percentage positive relationship between residual potential and entrepreneurial trait and it is significant at 1 percent level.

The correlation coefficient between residual potential and entrepreneurship development is 0.235, which means that every one unit increase or decrease in residual potential will impact on entrepreneurship development by 23.5 percent increase or decrease in the same direction. Correlation coefficient between entrepreneurial trait and entrepreneurship development is 0.415 which shows 41.5 percent positive correlation exists between entrepreneurial traits and entrepreneurship development and is statistically significant at 1 percent level. Hence the null hypothesis is rejected at 1% significant level and concluded that there exist a significant relationship between entrepreneurship development and factors of entrepreneurship development.

To test the statistical significance the following hypothesis is tested.

\[ H_0: \text{There is no significant relationship between entrepreneurship development and factors of entrepreneurship development among differently abled entrepreneurs.} \]

**Table 1.3: Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.936</td>
<td>0.876</td>
<td>0.874</td>
<td>2.078</td>
</tr>
</tbody>
</table>

**Source: Primary Data.**

**Table 1.4: ANOVA**

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4463.998</td>
<td>2</td>
<td>2231.999</td>
<td>516.963</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>634.676</td>
<td>147</td>
<td>4.318</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5098.673</td>
<td>149</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source: Primary Data.**

**Table 1.5: Regression Coefficient**

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>-10.886</td>
<td>1.008</td>
<td>-10.801</td>
</tr>
<tr>
<td></td>
<td>Overall Residual Potential</td>
<td>0.104</td>
<td>0.010</td>
<td>0.665</td>
</tr>
<tr>
<td></td>
<td>Overall Entrepreneurial Traits</td>
<td>0.052</td>
<td>0.011</td>
<td>0.293</td>
</tr>
</tbody>
</table>

**Source: Primary Data.**

**Dependent Variable: Entrepreneurship Development**

\[ Y = a + b_1X_1 + b_2X_2 \]

Where, \( Y = \text{Entrepreneurship Development} \)

\( X_1 = \text{Residual Potential} \)
X2 = Entrepreneurial Traits
b1 and b2 are regression coefficients.

1.1 Result of the Regression Model
1. Following values are noticed for regression coefficients
   Intercept ‘a’ = -10.886 (For Entrepreneurship Development)
   b1 = 0.104 (For Residual Potential)
   b2 = 0.052 (For Entrepreneurial Traits)
2. Overall model is found to be significant. The significant value in the ANOVA table is 0.001 which is less
   than 0.001. Thus the null hypothesis of ANOVA is rejected (Table 1.4).
3. The ‘p’ value for residual potential is 0.000 which is less than 0.01, hence the null hypothesis that there
   is no relationship between residual potential and entrepreneurship development is rejected (Table 1.5).

1.2 Structural Equation Model (SEM) on Entrepreneurship Development of Differently-Abled Entrepreneurs
The Variables used in the structural equation model are
I. Observed, endogenous variables
   1. Determination
   2. Skills for Coping with Emotions
   3. Problem Solving Skills
   4. Critical Thinking
   5. Creative Thinking
   6. Inter-Personal Relationship
   7. Communication Skill
   8. Sympathy
   9. Environmental Adaptation
   10. Empathy
   11. Self –Awareness
   12. Adaptive Ability
   13. Decision Making Capacity
   14. Risk Bearing Capacity
   15. Business Vision
   16. Independence in Work
   17. Optimism
   18. Need for Achievement Motivation
   19. Innovation
   20. Hard Work
   21. Entrepreneurship Development

II. Unobserved, exogenous variables
   1. e7: Error term for Determination
   2. e6: Error term for Skills for Coping with Emotions
   3. e5: Error term for Problem Solving Skills
   4. e4: Error term for Critical Thinking
   5. e3: Error term for Creative Thinking
   6. e2: Error term for Inter-Personal Relationship
   7. e1: Error term for Communication Skill
   8. e11: Error term for Sympathy
   9. e10: Error term for Environmental Adaptation
   10. e9: Error term for Empathy
   11. e8: Error term for Self –Awareness
   12. e20: Error term for Adaptive Ability

The ‘p’ value for entrepreneurial trait is 0.000 which is less than 0.01, hence the null hypothesis that there
is no relationship between entrepreneurial trait and entrepreneurship development is rejected and alternative hypothesis is accepted.

The entrepreneurship development among differently abled entrepreneurs in South India is dependent on many factors like residual potential and entrepreneurial traits. Although there have been many other factors such as skill development and entrepreneurship training programmes for entrepreneurship development for the same period, the entrepreneurship development among differently abled entrepreneurs shown an increasing trend in the number of beneficiaries and the number of business ventures.
13. e19: Error term for Decision Making Capacity
14. e18: Error term for Risk Bearing Capacity
15. e17: Error term for Business Vision
16. e16: Error term for Independence in Work
17. e15: Error term for Optimism
18. e14: Error term for Need for Achievement Motivation
19. e13: Error term for Innovation
20. e12: Error term for Hard Work
21. Entrepreneurial Trait
22. e21: Error term for
23. Residual Potential

Hence number of variables in the Structural Equation model is

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of variables in your model</td>
<td>44</td>
</tr>
<tr>
<td>Number of observed variables</td>
<td>21</td>
</tr>
<tr>
<td>Number of unobserved variables</td>
<td>23</td>
</tr>
<tr>
<td>Number of exogenous variables</td>
<td>23</td>
</tr>
<tr>
<td>Number of endogenous variables</td>
<td>21</td>
</tr>
</tbody>
</table>
Fig. 1.1. Structural Equation model (SEM) based on Standardised Coefficient on Entrepreneurship Development of Differently-Abled Entrepreneurs.
<table>
<thead>
<tr>
<th>Variables</th>
<th>Residual Potential</th>
<th>B</th>
<th>S.E</th>
<th>Standardised coefficient (Beta)</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication skill</td>
<td>1.795</td>
<td>0.278</td>
<td>0.502</td>
<td>6.452</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Inter-personal relations</td>
<td>3.750</td>
<td>0.355</td>
<td>0.744</td>
<td>10.551</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Creative thinking</td>
<td>3.496</td>
<td>0.311</td>
<td>0.777</td>
<td>11.235</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Critical thinking</td>
<td>3.580</td>
<td>0.434</td>
<td>0.616</td>
<td>8.242</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Problem solving skill</td>
<td>3.176</td>
<td>0.480</td>
<td>0.513</td>
<td>6.617</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Skill for coping with emotions</td>
<td>1.509</td>
<td>0.181</td>
<td>0.621</td>
<td>8.324</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Determination</td>
<td>2.559</td>
<td>0.432</td>
<td>0.465</td>
<td>5.921</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Self awareness</td>
<td>5.243</td>
<td>0.339</td>
<td>0.946</td>
<td>15.450</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Empathetic</td>
<td>2.192</td>
<td>0.182</td>
<td>0.816</td>
<td>12.077</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Environmental Adaptation</td>
<td>2.699</td>
<td>0.502</td>
<td>0.427</td>
<td>5.377</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Sympathy</td>
<td>3.450</td>
<td>0.254</td>
<td>0.879</td>
<td>13.593</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Hard work</td>
<td>4.393</td>
<td>0.507</td>
<td>0.640</td>
<td>8.668</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Innovation</td>
<td>2.851</td>
<td>0.344</td>
<td>0.618</td>
<td>8.297</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Need for Achievement Motivation</td>
<td>2.654</td>
<td>0.390</td>
<td>0.524</td>
<td>6.813</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Optimism</td>
<td>1.961</td>
<td>0.149</td>
<td>0.860</td>
<td>13.147</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Independency in Work</td>
<td>2.552</td>
<td>0.375</td>
<td>0.524</td>
<td>6.799</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Business Vision</td>
<td>5.202</td>
<td>0.330</td>
<td>0.956</td>
<td>15.786</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Risk Bearing capacity</td>
<td>2.159</td>
<td>0.163</td>
<td>0.864</td>
<td>13.227</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Decision making Capacity</td>
<td>3.772</td>
<td>0.266</td>
<td>0.902</td>
<td>14.208</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Adaptive Ability</td>
<td>5.303</td>
<td>0.367</td>
<td>0.911</td>
<td>14.460</td>
<td>&lt;0.001**</td>
<td></td>
</tr>
<tr>
<td>Entrepreneurship Development</td>
<td>2.566</td>
<td>1.274</td>
<td>0.440</td>
<td>2.014</td>
<td>0.044*</td>
<td></td>
</tr>
<tr>
<td>Entrepreneurship Development</td>
<td>2.543</td>
<td>1.270</td>
<td>0.436</td>
<td>2.002</td>
<td>0.045*</td>
<td></td>
</tr>
</tbody>
</table>

1. Based on Standardised coefficient, Entrepreneurial Trait on Business Vision (0.956) is the most influencing path in this SEM model.

2. Followed by Residual Potential on Self Awareness (0.946), Entrepreneurial Trait on Adaptive Ability (0.911), Entrepreneurial Trait on Decision Making.

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Capacity (0.902), Residual potential on Sympathy (0.879), Entrepreneurial trait on Risk bearing capacity (0.864), Entrepreneurial trait on Optimism (0.860).

3. Followed by Residual potential on Empathy (0.816), Residual potential on Creative Thinking (0.777), Residual potential on Inter-personal Relations (0.744), Entrepreneurial Trait on Hard Work (0.640), Residual Potential on Skill for Coping with Emotions (0.621).

4. Entrepreneurial Potential on Innovation (0.618), Residual potential on Critical thinking (0.616), Residual Potential on Problem Solving Skill (0.513), Residual Potential on Communication Skill (0.502), Residual Potential on Determination (0.465), Residual Potential on Environmental Adaptation (0.427), Standardised coefficient of Entrepreneurial Trait on Independence in Work (0.524) and Entrepreneurial Trait on Need for Achievement Motivation are equally influencing path in this mode.

5. Least influencing paths are Residual potential on Entrepreneurship Development (0.440), Entrepreneurial Trait on Entrepreneurship development (0.436) and Residual Potential on Environmental Adaptation (0.427),

For the purpose of testing the model fit, null hypothesis and alternative hypothesis are framed

HYPOTHESIS X

Null hypothesis: H0 : The hypothesized model has a good fit.
Alternate hypothesis: Ha : The hypothesized model does not have a good fit.

Table 1.6: Regression Indices and Values

<table>
<thead>
<tr>
<th>Indices</th>
<th>Value</th>
<th>Suggested value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square value</td>
<td>643.506</td>
<td>-</td>
</tr>
<tr>
<td>DF</td>
<td>187</td>
<td>-</td>
</tr>
<tr>
<td>P value</td>
<td>0.000</td>
<td>&gt; 0.05 (Hair et al., 1998)</td>
</tr>
<tr>
<td>Chi-square value/DF</td>
<td>3.441</td>
<td>&lt; 5.00 (Hair et al., 1998)</td>
</tr>
<tr>
<td>GFI</td>
<td>0.938</td>
<td>&gt; 0.90 (Hu and Bentler, 1999)</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.913</td>
<td>&gt; 0.90 (Hair et al., 2006)</td>
</tr>
<tr>
<td>NFI</td>
<td>0.989</td>
<td>&gt; 0.90 (Hu and Bentler, 1999)</td>
</tr>
<tr>
<td>CFI</td>
<td>0.946</td>
<td>&gt; 0.90 (Daire et al., 2008)</td>
</tr>
<tr>
<td>RMR</td>
<td>0.066</td>
<td>&lt; 0.08 (Hair et al. 2006)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.055</td>
<td>&lt; 0.08 (Hair et al. 2006)</td>
</tr>
</tbody>
</table>

From the above table it is found that, Goodness of Fit Index (GFI) value (0.938) and Adjusted Goodness of Fit Index (AGFI) value (0.913) are greater than 0.9 which represent, that it is a good fit. The calculated Normed Fit Index (NFI) value (0.989) and Comparative Fit Index (CFI) value (0.946) indicates that it is a perfect fit and also it is found that Root Mean square Residuals (RMR) value (0.066) and Root Mean Square Error of Approximation (RMSEA) value (0.055) which are less than 0.08 which indicated it is a perfectly fit model.

All model fit indices reached satisfactory levels, the predictive p value (0.000) and Chi-Square value (643.506) are non-significant, the significance of the Chi-square value depends on sample size and normality, Chi-square test is the only substantive test of fit for SEM (Barrett, 2007). It is a known problem that these indices are biased with small sample size and a large number of variables (Fan et al., 2011; Kenny & McCoach, 2003; Schumacker & Lomax, 2004). Hence the Chi-square value/DF is (3.441) and better model indices of RMSEA (0.055), CFI (0.946), NFI (0.989), GFI (0.938) and AGFI (0.913) values indicate a good model fit and we can accept the null hypothesis that the model is correct.

Conclusion

Human development insists that everyone should enjoy a minimum level of security in social and economic terms. The root cause of social insecurity among differently abled persons in India is poverty and that is largely due to the lack of adequate employment opportunities. The pattern of economic development in India is with variety of inequalities. Indian economy has performed well in terms of growth rate but poor in terms of human development indicators. In such a situation entrepreneurship development is a tool to generate income and employment for all sections of the society. In this study, the core idea is about entrepreneurship development among differently abled persons and to identify the innate potentialities and entrepreneurial traits among differently abled persons for success in their ventures. The result shows that factors of residual potential and entrepreneurial traits have positively contributed to entrepreneurship development and ultimately lead to the overall development of differently abled entrepreneurs.

VIII. FINDINGS

1. Final regression model includes Residual Potential and Entrepreneurial Trait as independent variables to predict Entrepreneurship Development. The overall model is found to be a significant determinant of Entrepreneurship Development as it has predicted by 87% variation in the dependent variable. ($R^2 = 0.876$)

2. The two independent variables, residual Potential and Entrepreneurial trait are observed to be significant determinants of Entrepreneurship Development (Table 1.5).

3. Residual Potential has regression coefficient 0.104 indicating a positive relationship with Entrepreneurship development. Every one unit increase or decrease in Residual Potential value will impact the Entrepreneurship Development by 0.104 times in the same direction.

4. Entrepreneurial Trait has regression coefficient 0.052 indicating a positive relationship with Entrepreneurship development. Every one unit increase or decrease in Entrepreneurial trait value will impact the Entrepreneurship Development by 0.052 times in the same direction.
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**Spiked Helmet Sign in Electrocardiogram, Sign of Hypomagnesaemia: A Case Study**

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**Abstract:** Magnesium is the second most common intracellular cation and serves as an important metabolic cofactor to over 300 enzymatic reactions throughout the human body. Among its various roles, magnesium modulates calcium entry and release from sarcoplasmic reticulum and regulates ATP pumps in myocytes and neurons, thereby regulating cardiac and neuronal excitability. This paper reports a patient suffering from severe hypomagnesaemia. In whose electrocardiogram, a transient ST elevation, deep T wave inversions in inferior leads (II, III, AVF) and QT prolongation has been observed. The pattern in the electrocardiogram of that patient represents the sign of a Spiked helmet. This sign in electrocardiogram, thus, can be correlated with patients having severe deficiency of Mg and form a first-hand tool for investigating such patients.

1.1. Introduction

Magnesium has attracted attention as an essential element with diverse roles in the regulation of cardiac contraction. Chronic suboptimal intake of the element results in hypomagnesaemia. Reduction in extracellular magnesium affects myocardial excitability and contractility predominantly, by modulation of the levels of other ions that have an influence on cardiac mechanics. Electrical excitability is enhanced in magnesium deficiency, and arrhythmic changes are presumed to be mediated by disturbance in K⁺ homeostasis [1]. Thiazide diuretics have frequently been recommended as initial therapy in patients with mild to moderate hypertension. However, their undesirable metabolic consequences have been suspected of contributing to increases in cardiovascular morbidity and mortality. Even at low doses, there is a definite decrease in both potassium and magnesium levels [2]. In a study, it has been seen that, electric stimulation (indirect via the nerve or direct) produced tetanic contractions and increased force at increasing stimulation frequencies. Significantly lower frequencies were needed to elicit these effects when intra- and extracellular Mg levels were low, in comparison to plentiful Mg supply. Comparing unstimulated and stimulated diaphragmatic tissue electrolyte concentrations revealed tissue losses of Mg, K, Ca from stimulated tissues which were less pronounced when Mg supply was optimal.

The exact mechanism of the spiked helmet ECG pattern and its association with critical illness is uncertain, but several observations point to the possible role of the diaphragm. Certain pathological conditions can rarely result in repetitive contraction of the diaphragm that is in concert with the cardiac cycle [3, 4]. Postulated mechanisms of this pulsatile diaphragmatic motion include direct stimulation of the diaphragm by the inferior wall of the left ventricle or triggering of the left leaf of the diaphragm by the left phrenic nerve. Such diaphragmatic contractions may result in alteration of the ST segment, which is best seen in the inferior leads [5, 6, 7]. Hypomagnesemia is common, occurring in about 20% of hospitalized patients and up to 65% of critically ill patients [8, 9]. Hypomagnesemia is generally asymptomatic. Symptoms commonly occur once the serum magnesium concentration falls below 1.2 mg/dl [10].

1.2. Case History and Discussion

A 57 year old female know hypertensive, type-II diabetes and DCM (EF 28%) on diuretics presented with dizziness in the department of cardiology SMHS Hospital Srinagar Kashmir. She gave history of palpitations also prior to dizziness. However, the clinical examination of the patient was normal. Then, the patient was subjected to Electrocardiography, the details of which are shown in Fig. 1.1.
Electrocardiography revealing poor R wave progression, T wave inversions in I, II, III, AVF leads, QT Prolongation with apparent ST-segment elevation and the upward shift starting before the onset of the QRS complex (Fig. 1.1). The ECG report obtained for the present case looks similar to what has already been reported [11]. That showed a dome-and-spike pattern, giving the appearance of Pickelhaube, the German military spiked helmet introduced in 1842 by Friedrich Wilhelm IV, King of Prussia as shown in Fig. 1.2.

Table 1.1 shows the hematological and other laboratory parameters of the patient.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemogram (g/dl)</td>
<td>11.4</td>
</tr>
<tr>
<td>White cell count (per mm³)</td>
<td>7800</td>
</tr>
</tbody>
</table>
Table 1.1

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platelet count (per mm³)</td>
<td>1.64 lac</td>
</tr>
<tr>
<td>Urea (mg/dl)</td>
<td>54</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>1.3</td>
</tr>
<tr>
<td>Bilirubin (mg/dl)</td>
<td>1.1</td>
</tr>
<tr>
<td>Aspartate transaminase (U/L)</td>
<td>34</td>
</tr>
<tr>
<td>Alanine transaminase (U/L)</td>
<td>31</td>
</tr>
<tr>
<td>Glucose (mg/dl)</td>
<td>102</td>
</tr>
<tr>
<td>Calcium (mg/dl)</td>
<td>8.2</td>
</tr>
<tr>
<td>Magnesium (mg/dl)</td>
<td>1.18* (0.06mmol/L)</td>
</tr>
<tr>
<td>Potassium (mg/dl)</td>
<td>2.78</td>
</tr>
</tbody>
</table>

Clearly, the patient is having anemia with mild renal involvement (eGFR = 42 ml/min/1.73m²). However ultrasoundography abdomen showed normal sized kidneys, and echo texture and CMD maintained. Her liver functions were normal. We found severe hypomagnesaemia* and mild hypokalemia. However serum calcium was lower normal. Echocardiography of this patient revealed DCM, severe LV dysfunction [EF 28%], RWMA. Her cardiac markers were negative (Troponins).

After treatment with intravenous magnesium of 2 gm stat given over 5 minutes. The patient was then followed by 4 gm intravenous infusion over 24 hrs and the dose was repeated as necessary to main the plasma concentration above 1 mg/dl. Patient’s reduced renal functions were taken into consideration while treating the patient. The patient seems recovering within minutes and the Spiked Helmet pattern in the patient’s electrocardiogram disappears as is clearly visible in Fig. 1.3.

What we infer from the case is that since the postulated mechanism for Spiked Helmet sign in electrocardiogram is the result in repetitive contraction of the diaphragm that is in concert with the cardiac cycle. We know hypomagnesaemia increases the excitability of muscle cells, thus increases the contractions of cardiac muscle. The patient had severe hypomagnesaemia and that could be the reason for Spiked Helmet sign in electrocardiogram which is a rare presentation. Cardiac and neuronal dysregulaion (palpitation and dizziness) secondary to severe hypomagnesemia subsided with normalization of magnesium. We have seen normalization of

Fig. 1.3: Electrocardiogram after treatment
electrocardiogram with normal magnesium levels. Moreover this sign is a marker of high mortality. Spiked helmet sign which is known to occur in critically ill patients, the only reason could be hypomagnesaemia in them.

3.3. Conclusion

Electrocardiography is a cheapest and highly informative investigation available to us and will predict the mortality associated with the level of hypomagnesaemia. The Spiked helmet sign, as seen in non-cardiac illnesses like hypomagnesaemia, in electrocardiogram provides a first-hand tool to analyze the severity of the deficiency of Mg.

Conflicts of Interest: There is no conflict of interest with the Institute from where the work has been carried out.

References

Chapter 14 of the Constitution and Implementation of Devolution in Zimbabwe

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Abstract- This article examines the constitution driven process of devolution in Zimbabwe. With a particular focus on local governments, the paper highlights the objectives of the 2013 Constitution in revamping local governance and improving good governance. The most critical objective is the devolution of power from central government to local government, a fundamental principle of good governance which was virtually absent in a centralised system of governance. With the enactment of the 2013 Constitution, it was hoped that through local governments, public participation, peace and unity would be enhanced as well as an improvement in the equitable distribution of resources. However, events on the ground show that since 2013, devolution is still a fallacy as evidenced by the underdevelopment and marginalisation of resource rich provinces in Zimbabwe. The paper notes that the delays in implementing devolution can be attributed to the non-alignment of local governance legislative pieces to the constitution and the lack of political will by the central government to devolve authority and resources to local governments. To expedite the devolution process, the paper concludes by suggesting the alignment of legislative pieces to the constitution and the amendment of the entire Chapter 14 under thorough public consultations and debates.

Index Terms- devolution, local governance, constitution, central government, good governance

I. INTRODUCTION

The constitution is the supreme legislative instrument of a country and all laws, Acts and practices should be aligned to the constitution. According to Kersting et al. (2009), a constitution is a legislative instrument that defines, organises and distributes governance and state power. It is a higher law that manages the operations of a government’s institutions, political power and the rights of the citizens in a given country. At the epicentre of local governance, as outlined in the 2013 Constitution of Zimbabwe under section 264 (2) is the issue of devolution. Devolution refers to the transfer of legislative, administrative, executive and fiscal decision making power to local governments that have a clear jurisdiction to which they provide public services (Muchadenyika, 2013). When the highest level devolves its functions, it transfers authority for decision making to the lower tiers of local government. For example, devolution involves the transfer of responsibilities for services to local authorities that elect their own mayors and councils and raise their own revenues (World Bank, 2020).

This paper specifically examines the concept of devolution as stipulated under section 264 of the 2013 Constitution. Subsection 2 of 264 outlines the six objectives of local government as follows; to give powers of local governance to the people and enhance their participation in the exercise of the powers of the State and in making decisions affecting them; to promote democratic, effective, transparent, accountable and coherent government in Zimbabwe as a whole; to preserve and foster the peace, national unity and indivisibility of Zimbabwe; to recognise the right of communities to manage their own affairs and to further their development; to ensure the equitable sharing of local and national resources; and to transfer responsibilities and resources from the national government in order to establish a sound financial base for each provincial and metropolitan council and local authority.

This paper seeks to find common ground upon which devolution as outlined in section 264 (2) can improve good local governance. It also discusses the implications of the delays in aligning local governance legislature to the 2013 Constitution. The next section provides a conceptualisation of devolution, followed by an interpretation of section 264 (2) with respect to the devolved objectives of local government in Zimbabwe.

II. UNPACKING THE CONCEPT OF DEVOLUTION IN ZIMBABWE

Devolution refers to the transfer of power and resources by central government to local governments that have clear jurisdictions or constituencies which they provide public services to. In a devolved system, Muchadenyika (2013) explains that, the central government does not exercise full control over local governments, rather, it plays an over sight role to ensure that local governments operate within the framework of national policies. A key function of devolution is the equitable transfer of natural resources management to local communities and institutions both within and outside of government (Edmunds et
al., 2003). Therefore, devolution can be viewed as a vehicle to drive economic growth.

In the Zimbabwean context, devolution is enshrined in Chapter 14 of the 2013 Constitution. Chapter 14 devotes section 264 to the devolution of political power, decision making, distribution of resources and governance to the three tiers of government. These three tiers include; the central government, provincial and metropolitan councils and local governments. In terms of local governments, which are the main focus of this paper, these are the grassroots level institutions which are more in touch with local communities and whose functions are conferred by the central government. Local government is the nearest link between central government and local communities and acts as a conduit through which central government manages individual communities.

Local governments are composed of urban and rural councils which are led by elected officials. Some of the officials are appointed on the basis of their expertise and ability to interpret national laws and policies for the effective running of local government. In addition, local government is also composed of councillors who are elected by community members using constitutional provisions outlined in Chapter 14 section 274 (urban councils) and section 275 (rural councils). This enables local governments to identify and address the needs of local communities. The election of councillors also allows communities to access their representatives thus enabling their voices to be heard in decision making processes that impact service delivery and development of their communities. The constitution also outlines the objectives of devolution for local governments within which they will implement their functions. These are interpreted in the next section.

III. INTERPRETATION OF CHAPTER 14 SECTION 264 (2) OF THE CONSTITUTION

As part of devolving the powers of central government to local governments, Section 264 (2) of the Constitution outlines six objectives for devolution.

The first objective, section 264 (2a), empowers local governments with the responsibility of strengthening public participation in development and democratic processes. By so doing, devolution affords members of the community with a greater voice on local governance and control of issues that affect the very essence of their lives. According to Chikerema (2013), public participation is a necessary component for community development and should be incorporated in local governance processes. Makumbe (1996) also views public participation as only meaningful if people are empowered to actively participate in various developmental and democratic processes.

As such, local governments have several platforms which can transfer powers of local governance to the people and strengthen their participation in democratic processes. For example, local government can strengthen citizen participation through participatory budgeting processes. Ganauz and Baicocchi (2019) define participatory budgeting as the process of democratic consultations and decision making were citizens are able to decide how a local government’s budget can be disbursed or allocated. In the Zimbabwean local government system, budget proposals are published in newspapers to give the public a chance to analyse and deliberate on the budget. The transfer of local governance to the public as provided for in section 264 (2a) is further reinforced by the Urban Councils Act of 2015 which includes participatory budgeting as a strategy to promote local democracy in local government. Therefore, this ensures a guided budget in a devolved system of governance as well as promoting public participation within the local government system.

Citizens can take also part in local government elections were they can express their views and choices. By selecting local leaders of their choice, citizens can freely select suitable officials to hold public office. A major advantage of this is that, leaders chosen from the local community are able to understand and articulate the needs of their community members from a grassroots perspective. In addition, locally elected leaders are in touch with their local communities on a day to day basis hence, increasing accountability and transparency of local government processes, which are provided in the second objective, section 264 (2b) which states that local governments are to ‘to promote democratic, effective, transparent, accountable and coherent government in Zimbabwe as a whole’. That said, democracy is achieved when citizens are allowed to elect leaders of their choice in a free and fair environment.

Proponents of devolution such as Chigumira et al. (2019) and Fonsshell (2018) argue that devolution curbs corruption and inefficiency. According to Ngigi and Busolo (2019), devolution helps to establish institutions that are more accountable and an effective system of good governance. The fact the local government in Zimbabwe in entrusted with the role of promoting public participation in local governance in the first objective 264 (2a), also means that the good governance systems that are created are bound to be more efficient and transparent. When resources are distributed to local communities, it makes it easier to manage them in an accountable and transparent manner (Chikerema, 2013).

The third objective, section 264(2c), presents the need ‘to preserve and foster peace, national unity and indivisibility of Zimbabwe’. In this objective, the 2013 Constitution recognises the power of local governments in national peace and reconciliation efforts. For example, in the implementation of the Gukurahundi healing and reconciliation, local governments in the Matebeleland and Midlands provinces have been assisting central government in conducting mapping exercises to ascertain the affected communities and special needs of survivors of Gukurahundi. In addition, local governments have also facilitated dialogue between affected community members and the National Peace and Reconciliation Commission (NPRC) as part of the central government’s plan to foster peace and unity amongst the victims of the 1980s atrocities.

This comes in the wake of the new dispensation, led by President Mnangagwa, which is eager to bring closure to the grievances of local communities and families which were affected by the
killing of civilians in the south-western parts of Zimbabwe in the 1980s. These grievances if left unresolved may lead to disunity and tribal conflicts between the aggrieved persons who were mostly of Ndebele origin, the central government and other tribes perceived to more privileged. Moreover, the devolution of power to local governments by the 2013 Constitution, will also empower marginalised communities to raise their own revenues to ensure effective service delivery.

According to Chirisa et al. (2013), Matebeleland has suffered developmental neglect stemming from the Gukurahundi atrocities which left the region marginalised and devoid of any development initiatives from the central government. Before the 2013 Constitution, local governments in the region depended on central government for financial resources and decision making which was mostly ‘red taped’ to stifle any development (Rwodzi, 2018). This resulted in limited authority to manage key services such as health and water provision, bureaucracy and weak local councils. Thus, the devolution objectives in the Constitution will engender peace, unity, good governance and local participation to previously marginalised communities.

The fourth objective, Section 264 (2d) assigns local governments ‘to recognise the right of communities to manage their own affairs and to further their development’. Devolution strengthens local democracy by acknowledging the right for communities to make decisions on issues affecting their lives. Thus, local democracy allows local communities to make their own decisions on matters that affect them directly. In the context of local governance, democracy is then referred to as the participation of the public in decisions that affect them (Tsobanoglou, 2018). By recognising local democracy, the Constitution also strengthens people’s voices and equitable access to resources through their chosen leaders.

This is followed by the fifth objective, Section 264 (2e) which speaks to the equitable distribution of local and national resources. This sub-section realises that natural resources provide immense potential for the development of local communities. As Shackleton et al. (2002) notes, natural resources, if distributed fairly, can lead to improved livelihood opportunities, revenue generation, infrastructural development and employment generation. The concept of devolution also involves the beneficiation and value addition of resources found in each district. Instead of exporting them in their raw state for further processing, value addition should occur in their places of origin in order to benefit local communities (Chigumira et al., 2019). This can also foster mutually beneficial partnerships between local communities, local governments and the central government.

Zimbabwe’s CAMPFIRE philosophy is evidence of the equitable distribution of local and national resources as outlined in Section 264 (2e). It is considered as one of Africa’s most successful devolution projects were authority was transferred to Rural District Councils (RDCs) by the department of National Parks and Wildlife Management through the Parks and Wildlife Act Chapter 20:14 for the protection of natural resources. Devolution allowed the community to share the benefits accrued by wild life utilisation in those lands (Biggs et al., 2019). Employment was also generated for the local people. Thus, section 264 (2) is premised on the fact that for economic development to take place, local development needs to occur first. For these reasons, proponents of devolution argue that devolution of power boosts local development and promotes efficient public service delivery by local governments.

The final objective, Section 264 (2f) is concerned with the transfer of responsibilities and resources from central government to local government. This will enable local governments to establish their own financial reserves for the efficient delivery of services. It is without doubt that local governments’ ability to generate revenue also determines their success and viability. Although central government continues to have an oversight role on local governments, the degree to which local governments generate their own revenue and make decisions on how to use this revenue is a determinant of local autonomy. Hence, the transfer of powers to local governments to enable them to establish a sound financial base as enshrined in the Constitution is an important indicator of financial autonomy.

This section concludes that there is a symbiotic relationship between each objective of devolution of local governance as outlined in Section 264(2). One objective cannot function without the other and a break in the link can have a negative impact on the total devolution process. For example, if local governments are corrupt and unaccountable, it means that they cannot sustain or generate revenues for effective public service delivery to their communities. Consequently, this would cause disgruntlement amongst community members and conflict between community members, local governments and central government. Having interpreted section 264 (2), the paper proceeds to analyse the current state of devolution in Zimbabwe’s local government. The next section questions how the events on the ground have complied with (or contradicted) with Section 264 (2).

IV. EVENTS ON THE GROUND

Whilst the 2013 Constitution has made several provisions for devolution in Zimbabwe, the events on the ground show that there are delays in implementing devolution. This delay can be attributed to lack of political will by the central government to distribute power and resources to local governments. At present, central government holds a tight grip on the management of natural resources which are a fundamental source of national revenue. Three provinces in Zimbabwe; Manicaland, Matebeleland and Midlands are heavily endowed with natural resources. Yet they are characterised by high rates of unemployment and poor infrastructure as compared to Harare province where central government is located, signalling a case where resources are extracted and processed for the benefit of other provinces.

It is therefore not surprising that during the constitutional making period (2009-2013), the three provinces, Manicaland, Matebeleland and the Midlands were at the forefront pushing for the devolution agenda (Moyo and Ncube, 2014). These provinces have immense potential of benefiting from their natural
resources, but the central government has implemented measures to retain central control by extracting the resources and shifting processing and marketing to the capital city (Moyo, 2013). As evidenced by the Marange Diamonds phenomenon, the equitable distribution of local resources as per section 264(2) is still marred by central control. The unfolding events since the discovery of the precious mineral in 2006 show that the tight grip on resource management has become a political tool against devolution in the name of compensating for resource imbalances across the country.

Maguwu (2013) argues that the Marange diamond fields have been patronised by the Zanu-PF party, showing that there is a strong link between politics and natural resources. The same people who sit on the Zimbabwe Consolidated Diamond Company (ZCDC) which is owned by the government, are members of the Zanu-PF party (Moyo, 2016), thereby compromising transparency of the resource’s extraction. In 2015, Fifteen Billion Dollars (USD$15 Billion) accrued from diamond sales was reported to be missing (GovZim, 2018). Sadly, none of these proceeds were channelled towards the development of the Marange community. To this day, Marange is characterised by dilapidated roads, clinics and its schools are in a deplorable state despite housing one of Southern Africa’s diamond fields. Beneficiation and value addition which are the heart of devolution have not taken place in Marange. The same can be said of the Midlands province were the profits accrued from platinum and gold sales have not been channelled towards the social and economic development of the province. Similarly, Hwange and Kariba produce electricity for nationwide consumption, yet the schools and homes surrounding Hwange, Kariba and Binga do not have electricity. Three of the country’s border posts in Matebeleland province (Kazungula, Beitbridge and Plumtree) and several tourist resort areas (Victoria Falls, Hwange National Park, Kariba dam and the Matopos) generate high foreign currency revenues which are all remitted to the state (Mhlanga, 2012). These areas remain poor and underdeveloped.

Consequently, the delays in implementing devolution spurred court cases particularly in the Matebeleland province in a bid to address the marginalisation and underdevelopment of the provinces. Two cases have been brought before the Constitutional Court (Concourt) of Zimbabwe, both compelling the state to uphold the Constitution’s provisions for devolution highlighted in section 264(2). In the first court case, the Mthwakazi political outfit led by Paul Siwela, approached the Concourt in 2014 to challenge the state to take appropriate steps to expedite implementation of devolution. Siwela argued that the state had failed to implement devolution within a reasonable timeframe since the enactment of the Constitution in 2013. The resultant delays in devolution had negative impacts on the development of the Matebele region which has been marginalised since the massacre of several Matabele civilians in the 1980s. Hence, Mapuva (2015) argues that devolution could contribute to the development of the region once local government was transformed from being a creature of the statute to being a constitutional provision.

In the same year, the state was again challenged by a former Minister of Water Resources, Development and Management, Samuel Sipepa Nkomo. Nkomo challenged the state for its failure to effect the provisions of the Constitution which brought into effect devolution in Zimbabwe. Devolution would allow the government to decentralise power from Harare to other provinces including Matebeleland, to enable all local governments to set their own priorities (Moyo, 2014). Devolution would also allow central government to establish provincial councils which would encourage social and economic development of the provinces. Currently, the government is in the process of amending the constitution in Constitution Amendment Bill Number 2. This Bill proposes a number of changes in the Zimbabwean Constitution. However, due to the prevailing global Coronavirus pandemic, the Parliament has not been able to convene public consultations of this Bill, though it accepted written submissions until the 17th of April 2020.

Of interest to the process of devolution, is the establishment of Provincial and Metropolitan councils. This amendment is part of the government’s initiative to cascade devolution to the local level. The amendment will see the removal of Members of Parliaments and Mayors from Provincial councils which would demarcate the legislative and national branch of governance from council business which is more concerned with resource mobilisation and allocation at the local level. This would be facilitated by the establishment of a 10 member council through a system of party list proportional representation.

Whilst these are positive steps towards the implementation of devolution, there are concerns that by creating a separate provincial chair and council body which runs alongside the city council and Mayor could result in a duplication of duties and jurisdictions and wastage of resources. Party list proportional representation could also create gaps for the political manipulation of the composition of council.

It can also be argued that the amendment is a piecemeal approach to devolution as it only targets section 272 of the Constitution. It seems that more focus on devolution has been afforded to provincial and metropolitan councils whilst neglecting local authorities. Such deliberate neglect in devolution debates leaves too much free play for central government to rescind powers and responsibilities given to local authorities as and when it sees fit. Yet, the Constitution in section 264 (2) recognises provincial, metropolitan and local authorities with equal measure. Therefore, the entire Chapter 14 should be carefully revised under thorough public consultations and debates to close such loopholes.

V. THE NEXUS BETWEEN DEVOLOPMENT AND GOOD GOVERNANCE

There are several perceived benefits to be accrued if devolution is implemented properly in Zimbabwe. Chief among them is the argument that devolution can improve good local governance in Zimbabwe. Given the weaknesses of decentralisation prior to the Constitution of Zimbabwe, devolution is argued to be the most effective form of decentralisation in that authority is transferred to local institutions that are best equipped to address specific issues (Tanyanyiwa, 2015). Compared to past local governance
structures which were creatures of the statute, devolution provides a better platform to solve problems whilst taking into cognisance the local contexts and local knowledge. Thus, devolution engenders democratization, good local governance and local participation.

On the one hand, local governments must be able to articulate the needs of the people at grassroots level (Olowu, 2009). On the other hand, local governments must act as a conduit through which central government implements policies and provides public services to the people (Mapuva, 2015). Good local governance reflects this dual function of local government. Good local governance is thus connected to those institutions and processes that work to meet the needs of local people, whilst making the best use of the available resources (O’Driscoll, 2018).

According to UNDP (2009), there are eight indicators of good local governance which include: transparency, rule of law, efficiency and effectiveness, accountability, representation, participation, consensus oriented and equity. However, citizen participation is considered to be an important marker of good local governance by the European Union and the UN Habitat. Good local governance involves citizens exercising their rights through their involvement in solving local problems. That said, devolution has the capacity to promote local democracy by enhancing citizen participation in the formulation and implementation of community development initiatives. This is clearly highlighted in the objectives of devolution set out in section 264 (2) that seek to devolve power and responsibilities to local governments in order to enhance citizen participation; promote democracy; preserve peace; empower citizens to manage their own affairs and; ensure the equitable distribution of local and national resources.

Proponents of devolution such as Zinyama and Chimanikire (2019) argue that it facilitates greater transparency and accountability which are also indicators of good governance. Improved transparency and accountability leads to increased efficiency and effectiveness of public services by bringing governance to the people. Nevertheless, Olum (2014) cautions that the success of devolution depends on the establishment of conducive conditions which support the implementation of devolution. These conditions include the alignment of legislative instruments of local governance to the Constitution, financial resources, political will and the engagement and participation of relevant actors involved in local governance. It remains to be seen whether the conditions for successful implementation are in place in Zimbabwe, in view of the fact that devolution is expected to drive Zimbabwe into upper middle income status by the year 2030.

Tanyaniyiwa (2015) also adds that devolution should be seen as a vehicle to drive local development through citizen participation, good governance and efficient delivery of public services. Through devolution, previously marginalised groups are included in local policy making thus increasing equity in resource distribution whilst cementing peace and unity. In addition, devolution to the lower tiers of government is further expected to improve citizen participation in policymaking as well as improving transparency and accountability. Citizen participation also increases the sense of ownership of the process, especially where development initiatives are drawn using an informed bottom up approach.

Pro-democracy groups and other community based organisation are also pushing for the implementation of devolution (Mushamba et al., 2014). They point out that devolution of responsibilities and resources will improve the lives of ordinary people. This is premised on the argument that through devolution, local governments are more likely to implement government projects that reflect regional and local needs as they are more in touch with the people at grassroots level. Local governments are like a conduit through which the central government provides public services to communities. Thus, these pro-democracy groups believe that devolution will address the ineffective public service system which was existent prior to devolution.

Devolution is also argued to be a remedy to the personalisation of power that had dominated local governments in the last two decades (Chigwata, 2019). Devolution is a shift from the previous decentralised local government legislature such as section 4 of the Urban Councils Act of 2002 which vested most executive powers to the Minister of Local Government (Mapuva and Miti, 2019). Hence, local governments can benefit from devolution of authority and responsibilities and cease to depend on a central authority for guidance in their decision making which breeds inefficiencies. Thus, devolving responsibilities and resources is expected to improve the decision making capacities of local governments which will also produce better development outcomes.

However, other critics have mixed views on the implementation of devolution. As argued by Moyo and Ncube (2014), instead of improving good local governance, devolution can be used as a political tool to create buffer zones against opposition parties. They note that the Zanu-PF party in particular, may use devolution to create a buffer zone against the MDC party which has previously combined advocacy for devolution with criticising Zanu-PF’s policies.

To foster good governance, devolution must transcend beyond local government levels down to the communities concerned. This is because, in a democratic environment, governmental powers belong to the people. If implemented properly, devolution can provide economic development to regions that were previously marginalised by centralised forms of development. Thus, devolution has the potential to address the grievances and marginalisation of provinces such as Manicaland, Matebeleland and the Midlands which have suffered from years of resource extraction without benefit to the local communities.

VI. IMPLICATIONS OF THE DELAYS IN HARMONIZING LEGISLATIVE INSTRUMENTS TO THE CONSTITUTION

It is without doubt that the delay in the alignment of various pieces of local government legislation to the Constitution has...
affected the implementation of devolution. Consequently, local governments have remained as creatures of the statute, dependent on central government for decision making power and financial resources. This in turn, has had negative implications on the efficiency, effectiveness and accountability of local governance structures in Zimbabwe.

The existence of local governance legislations which do not speak to the Constitution has affected the implementation of devolution in Zimbabwe. Such legislation includes the Local Government Amendment Act of 2016 Section 157 (1), which empowers the Minister to suspend Mayors and councillors, with the final dismissal being carried out by an independent tribunal that the Minister establishes himself in Section 157 (2 a and b). At face value, this seems to reinforce Section 278 (2) of the Constitution which states that a Mayor or councillor can be removed following a trial before an independent tribunal were he/she is found guilty of gross incompetence, misconduct, corruption and mental incapacity. In actual fact, whilst the Constitution has dissolved the Minister’s power to dismiss employees, he can still indirectly do so through an independent tribunal which he establishes under the Local Government Amendment Act of 2016.

Ideally, this means that nothing has changed since the promulgation of the Constitution in terms of central government’s interference in local governments. Prior to the implementation of the Constitution in 2013, the Minister of Local Government could dismiss a Mayor or Councillor arbitrarily and replace him with an official of his choice by citing the Urban Councils Act of 2015 section 54 (1) and (2). Even though the power of the Minister to dismiss mayors and councillors was repealed by the Local Government Amendment Act of 2016, the fact that the independent tribunal is appointed by the Minister, means that it is not truly ‘independent’ and is prone to manipulation by the Minister. This in turn affects the efficient and effective running of local governments as it creates conflicts and disgruntlement between the central government, the concerned local authorities and residents (Zinyama and Chimankire, 2019). Thus, delays in harmonising the Local Government Amendment Act of 2016 and Constitution of Zimbabwe will continue to delay any meaningful efforts towards devolution.

Mapuva (2015) attributes the delays in aligning such pieces of local governance legislature to the Constitution to lack of political will. He argues that these delays have created two parallel instruments of power, one emanating from local governance legislature and the other, from the Constitution. The use of both instruments has resulted in confusion and contradication. In some cases, this has also created gaps which allow the instruments to be manipulated to suit the situation. Mapuva (2015) articulates the arbitrary use of the previous Urban Councils Act of 2008, which allowed the Minister of Local Government to appoint special interest councillors in all urban councils.

Invoking the same Act, the Minister could also appoint and dismiss mayors and councillors willy-nilly. The officials were appointed along partisan lines and not based on their expertise or contribution to local governance. As a result, this compromised the efficiency, effectiveness and accountability of local governments and at the same time causing disgruntlement and controversy amongst citizens and the civil society (Mapuva, 2015).

This paper argues that whilst the Constitution has dissolved the Minister’s powers, the repackaging of the Urban Councils Act of 2008 and 2015 into the Local Government Amendment Act of 2016 still affords the Minister unfettered powers. Thus, the existence of parallel legislative systems is indicative of the lack of political will to harmonise existing legislation to the Constitution. Despite the objective of section 264 to devolve responsibilities and resources to local governments, the central government is still dominating the operations of local governments. As a result, the delays in devolution have had negative ramifications on the effectiveness, efficiency and accountability of local governments. The negative impact of the central government’s interference can clearly be seen in road and water service provision in Zimbabwe.

Since 1980, local governments derived their revenue base from water services tariffs and user fees. However, this source of revenue was taken away from local governments by the central government and transferred to the Zimbabwe National Water Authority (ZINWA) in 2006. ZINWA was given the authority to manage and distribute both primary and commercial sources of water. Primary water is water used for basic consumption whilst commercial water is bulk water from dams and rivers for agricultural purposes. This move, wedged conflicts between the central government and local governments as water constituted at least 80 percent of local councils’ revenue source (Gideon and Alouis, 2013).

Muchadenyika and Williams (2018) argues that this transfer was for political gains as the Zanu-PF party used ZINWA as a cash resource to finance the party’s operations. The service delivery was so poor that the role of urban water management and supply was returned back to local governments in 2009 after ZINWA failed to manage water and sanitation resources leading to the outbreak of cholera which claimed over 4000 lives in Harare (Muchadenyika, 2014). This is also prevalent in other parastatals which have been devolved to community levels but have failed to provide efficient services since they owe their accountability to the ruling party (Mutanda, 2014). For example, the Grain Marketing Board (GMB) has failed to ensure food security despite the low maize purchasing prices they offer and its numerous depots spread across the country. Directors and board members of most parastatals are appointed on the basis of political affiliation and not expertise.
VII. CONCLUSION

To conclude, whether devolution is successfully implemented in Zimbabwe will depend on the political will and participation of all stakeholders. Perhaps, it is by amending Chapter 14 that implementation of devolution will be expedited. However, devolution is not a once off occurrence but is a long haul policy reform, which will take the alignment of legislative pieces of local governance to the Constitution. The delays in aligning these pieces of legislation will continue to support the centralized control of local government and reduce local governments’ capacity to fully embrace the objectives of devolution. This will take time, but if devolution is supported by the people of Zimbabwe, implementation will soon be realized.

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“Preliminary Assessment Of The Lignocellulosic Raw Material - Fibrous (Cellulose) And Non-Fibrous (Lignin And Hemicellulose)”

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Abstract- The knowledge of the chemical composition of the prospective raw material under study is one of the essential prerequisites for characterization of effluent.

Since the present work deals with the investigation carried out an agricultural residue(wheat straw) the proximate chemical analysis have been carried out to compare the structural components of straw with hardwood with particular reference to the components which are of significant value in assessing the paper making potential on chemical basis.

I. INTRODUCTION

The determination of proximate chemical analysis is just preliminary assessment of the lignocellulosic raw material in terms of its fibrous (cellulose) and non-fibrous (lignin and hemicellulose) which undergoes chemical reaction during the cellulose extraction and subsequent bleaching chemical treatment. The condition employed for pulping, bleaching and the consumption of chemical depend upon the nature and chemical composition of the raw material used.

Bagasse is the fibrous residue remaining after sugarcane or sorghum stalks are crushed to extract their juice and is currently used as a renewable resource in the manufacture of pulp and paper products and building materials. India is one of the leading sugar cane producing country and bagasse is by product of the sugar industry and it is renewable fibre resource. It is observed that nearly 19 million tons of the bagasse being produced in the organized sector is adequate to produce 3 million tons of paper form pulp. As sugarcane is grown in most part of the country the sustained availability of bagasse to paper can be ensured. Further, with high density baling technology available the transportation should not be a problem. Thus, the abundance and easy transportation make bagasse an attractive fiber resource for paper industry.

Around 5%-10% of paper production worldwide is produced from agricultural crop, valuing agricultural paper production between $5 billion and $10 billion. Due to the ease with which bagasse can be chemically pulped, bagasse requires less bleaching chemicals than wood pulp to achieve a bright, white sheet of paper. The fibers vary in length depending on the country but the typically about 1.3 mm to 1.7 mm long. Bagasse fibers are well suited for tissue, corrugating medium, newsprint, and writing paper. The significant of each analysis is discussed below:

2.1.1 Ash Content:

Ash content include various inorganic salts of sodium, calcium, potassium, silica, iron, sulfates and chlorides etc. The agricultural residues are characterized by high ash content (3-18%) whereas the quantity of ash in wood is very low (0.2 to 0.8%). The high ash content in agricultural residues is mainly due to presence of silica. The silica present in the raw material enters the spent liquor during pulping and poses many problems in the chemical recovery process.

During concentration of the spent liquor, the silica forms a layer on the heat transform surface of the evaporator and reduce the heat transfer efficiency. The entry of chlorides into the system affects the thermal behaviour of the spent liquor, by increasing the eutectic point.

2.1.2 Solubility in Boiling Water:

Hot water solubility determination is a measure soluble component like starch, resins, pectin, low molecular weight polysaccharides and other extractives. This measurement helps in assessing the chemical requirements during pulping.

2.1.3 One Tenth Normal (N/10) Sodium Hydroxide Solubility:

This determination is a most informative parameter to assess the physicochemical nature of the raw material. It also gives an idea about the microbial decomposition/degradation of a particular raw material. The degradation of raw material is due to low molecular weight components.

2.1.4 Alcohol- Benzene Solubility:

Alcohol-benzene solubility constitutes the determination of waxes, fats, resinous matter and certain other low molecular weight soluble components. The ethanol-benzene is the most suitable combination for solubilizing major of the components soluble in organic solvents since no single organic solvent is capable of removing all these substance and different solvents remove different combinations.

2.1.5 Lignin:
Lignin is an amorphous three-dimensional complex polymer made up of phenylpropane units. It is binding material of fibers and imparts rigidity to the plants tissue. Estimation of lignin content in dusty samples is important and helps in arriving at conditions required for delignification during pulping. The lignin content of the spent pulping liquor is dependent upon the lignin content of the raw material and amount of lignin dissolved during pulping. Lignin is isolated from extractive free dust as acid insoluble residue after hydrolysis of polysaccharides with in 72% sulfuric acid (H₂SO₄). The lignin determination by the method called “Klason Lignin”, since Klason was the first person to carry out the reaction of wood dust with 72% of H₂SO₄ for quantitative determination of lignin.

2.1.6 Holocellulose:

Cellulose and hemicellulose are collectively termed as holocellulose. It constitutes nearly three fourth of the fibrous material. Holocellulose includes (i) alkali resistant alpha cellulose (ii) the water-soluble polysaccharides and (iii) the group of water insoluble and strong alkali, soluble hemicellulose portion is readily hydrolyzed by acid as compared to cellulose.

Cellulose is the major component of cell wall of wood fibers. It is the basic ingredient which is used in paper and rayon making. Cellulose is a linear polysaccharide of sufficient chain length and is insoluble in water or dilute alkali or acid room temperature. Cellulose constitutes 40-50% by weight of wood. On hydrolysis it forms glucose. Its chemical formula is (C₆H₁₀O₅)n, the value of n varies from 800 to 1500 and the building block is a D-glucosidic linkage.

Hemicellulose are the principle non-cellulosic polysaccharide present in plants tissue. These are deposited in the interface of the cellulose fiber in the primary as well as secondary cell of the plant materials. These are low molecular weight linear chain polymers, with degree of polymerization (DP) value of =100-200. There can be extracted by cold dilute alkalies from hemicellulose. The total hemicellulose content of wood varies between 15-35% major portion of hemicellulose contain pentosans. A low pentosan containing raw material is more suitable for paper grade pulp. Increased proportion of hemicellulose leads to higher proportion of carbohydrates derived acids in spent liquor and also affect the pulp and spent liquor properties.

10 kg of each sample (air dried) of rice straw and bagasse (whole bagasse and depithed bagasse) was collected from Mill A (Uttarakhand) and Mill B (Uttar Pradesh). Then raw material was dried in air and kept in polythene bag for maintain uniform dryness. The sample were converted into dust. The dust passing through 40 mesh and retained on 60 mesh was analysed for chemical composition.

2.2 EXPERIMENTAL

2.2.1 Preparation of Saw Dust of Raw Material:

For determining the chemical composition of the different components of the raw material, dust was prepared as per the method given below:

Sample of rice straw and bagasse was taken and a part of these raw material weighing nearly 400g was used the dust preparation in the Wiley Milling Machine. The material retained on 40 mesh was again converted into dust so that all the 400g of the raw material was converted into dust passing through 40 mesh screen and retained on 80 mesh as per the standard described in TAPPI method.

2.2.2 Determination of ash Content:

The dust of rice straw and bagasse sample (2.00 g o.d. basic) was taken in a pre-weighed platinum crucible and ignited at 575 ± 25°C in a muffle furnace to obtain the ash. The ignition was continued till constant weights were obtained the ash content was calculated as follows:

Ash content (%) = \[
\frac{B \times 100}{A}
\]

Where : A is the o.d weight of test specimen
B is the weight of residue left after ignition
The ash was divided into different parts for the estimation of different elements.

2.2.3 Determination of Silica:

Silica was determined by using the ash obtained as above (Determination of ash content), known quality of the ash was baked in a beaker with dil hydrochloric acid (HCL). After baking the silicic acid gel was filtered on ash-less whatman filter paper and washed thoroughly till free of chlorides. After washing the residue was ignited at 600°C in pre weighed platinum crucible and weighted after attaining constant weight. The residue of silica along-with other inorganics was treated with mixture of conc. H₂SO₄ and hydrofluoric acid (HF). The platinum crucible was slowly heated on sand bath to expel excess of H₂SO₄. Silica with HF forms silicon tetra fluoride, which is volatile on heating. The crucible was weight after igniting at 850°C. The loss in weight was expressed as silica in terms of percentage silica.

Silica was calculated as follows:

Silica (%) w/w = \[
\frac{A - B}{W} \times 100
\]

Where,
A is the weight of residue at 600® C
B is the weight of residue left after 800® C
W is the O.D weight of sample

2.2.4 Estimation of Calcium, Potassium:

The filtrate obtained after treatment of ash with HCL was used for analysis of calcium (Ca) and potassium (K) by Flame photometer. Flame photometer is based on the principle that for an atom to emit light, it has to be excited above its ground state by supplying enough energy to move one electron to high energy level orbit. The wavelength for potassium and calcium are 767 nm and 622 nm respectively and filters corresponding to these wavelengths were employed for determination of individual element. Standard of Ca, K in the range varying from 1-10 ppm were employed for calibration.
2.2.5 Determination of Hot Water Solubility:

Sample dust (2.00 g o.d basis) was taken in an Erlenmeyer Flask (250ml) fitted with a reflex condenser and 100 ml of distilled water was added to it. The flask was kept over a boiling water bath and refluxed continuously for 3 hours, making certain that the water levels is maintained constant. After 3 hours the contents of the flask were filtered into a crucible, washed thoroughly with hot distilled water and dried to constant weight at 105±3°C in an over.

Hot water solubility was calculated as follows:

\[
\text{Hot water solubility, (\%) } = \frac{(A-B) \times 100}{A}
\]

Where,

- A is o.d weight of test specimen before extraction
- B is o.d weight of test specimen after extraction

2.2.6 Determination of One Tenth Normal Sodium Hydroxide Solubility:

Sample dust of both the raw material rice straw and bagasse (2.00 g o.d basis) was placed in 250 ml concial flask and 100 ml of 0.1 N NaOH solution was added to it. The contents were boiled under reflux for one hour. After 1 hour, the contents of the flask were filtered into a crucible. The residue was further washed with hot distilled water followed by 50ml of 10% acetic acid and finally with hot distilled water. The crucible with content was dried in oven at 105±2°C till constant weight was obtained.

NaOH Solubility was calculated as follows:

\[
\text{N/10 NaOH solubility (\%) } = \frac{(A-B) \times 100}{A}
\]

Where,

- A is o.d weight of test specimen before extraction
- B is o.d weight of test specimen after extraction

2.2.7 Alcohol-Benzene Solubility:

It is a measure of waxes, fats, resins and other ether insoluble components. Dust sample (2.00 g o.d basis) was taken in a pre-weighed porous thimble which was placed in a soxhlet apparatus. The extraction was carried out with 150 ml of the solvent mixture containing 1 volume of ethanol (95% ethanol) and 2 volume of benzene for 6 to 8 hours, so that 24 extraction cycle were completed. After extraction the thimble was removed and dried in an oven at 105±2°C to a constant weight.

Alcohol-Benzene solubility was determined as follows:

\[
\text{Alcohol-Benzene solubility (\%) } = \frac{(A-B) \times 100}{A}
\]

Where,

- A is o.d weight is test specimen before extraction
- B is o.d weight of test specimen after extraction

2.2.8 Estimation of Klasson Lignin:

The alcohol-benzene extracted free dust sample (2.00 g o.d basis) were placed in a clean glass mortar to which 15.00 ml of 72% sulfuric acid was added gradually in small increments. While adding the acid, the dust of both the raw material was stirred and macerated continuously with glass rod. After 2 hours the material was transferred to one litre conical flask and the acid concentration was brought down to 3% by adding distilled water (575 ml). The contents of the flask were then boiled for 4 hours to accomplish the complete hydrolysis of carbohydrates. During this period, the total volume in the flask was maintained constant by frequent addition of hot distilled water.

After 4 hours the content were filtered into a crucible and thoroughly with hot distilled water until acid free. The crucible was dried to a constant weight at 105±2°C in an oven. The lignin was calculated as follows:

\[
\text{Klasson Lignin contents (\%) } = \frac{A \times 100}{W}
\]

Where,

- A is the o.d weight of lignin
- W is the o.d weight of test specimen

2.2.9 Determination of Holocellulose:

The basic principle of this method is selective dissolution of lignin by acid chlorite treatment. Extractive free dust samples of rice straw and bagasse (2.0 g o.d basis) were placed in 500-ml conical flask containing 160 ml distilled distilled water. The dust samples were then treated with sodium chlorite (1.5 g) and glacial acetic acid (0.5ml). The contents were placed on a hot water bath maintained at 75-80°C. After 1 hour, sodium chlorite (1.5g) and glacial acetic acid (0.5ml) were again added. The process was repeated till the sample residue became white. The contents were then filtered into a crucible and wasted with distilled water followed by acetone. The crucible was dried to a constant weight in an oven at 105±2°C.

Holocellulose was calculated as follows:

\[
\text{Holocellulose (\%) } = \frac{A \times 100}{W}
\]

Where,

- A is the o.d weight of holocellulose
- W is the o.d weight of the test specimen

Table 1: Proximate Chemical Analysis of Bagasse Mill A and Mill B

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Mill A</th>
<th>Mill B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Bagasse</td>
<td>Depithed Bagasse</td>
<td>Whole Bagasse</td>
</tr>
<tr>
<td>Depithed Bagasse</td>
<td>Whole Bagasse</td>
<td>Depithed Bagasse</td>
</tr>
</tbody>
</table>

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p10796 
www.ijsrp.org
Table 2: Proximate Chemical Analysis of Wheat Straw Mill A and Mill B

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Mill A</th>
<th>Mill B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ash, (%) w/w</td>
<td>6.40</td>
<td>5.91</td>
</tr>
<tr>
<td>Silica, (%) w/w</td>
<td>6.20</td>
<td>5.85</td>
</tr>
<tr>
<td>Calcium, (%) w/w</td>
<td>0.22</td>
<td>0.21</td>
</tr>
<tr>
<td>Potassium, (%) w/w</td>
<td>0.89</td>
<td>0.87</td>
</tr>
<tr>
<td>Pentosan, (%) w/w</td>
<td>18.90</td>
<td>18.30</td>
</tr>
<tr>
<td>Klason Lignin, (%) w/w</td>
<td>12.80</td>
<td>13.10</td>
</tr>
<tr>
<td>Holocellulose, (%) w/w</td>
<td>62.40</td>
<td>61.63</td>
</tr>
<tr>
<td>Alcohol-benzene solubility, (%) w/w</td>
<td>1.10</td>
<td>1.1</td>
</tr>
<tr>
<td>NaOH solubility, (%) w/w</td>
<td>48.00</td>
<td>46.89</td>
</tr>
<tr>
<td>Hot water solubility, (%) w/w</td>
<td>19.20</td>
<td>19.45</td>
</tr>
</tbody>
</table>

All values expressed on basis of O.D. raw material.

2.3 Result and Discussion:

Result of proximate chemical analysis of bagasse (whole bagasse and depithed bagasse) and rice straw are shown in table 1 and 2. The ash content indicates the mineral constituents present in the raw material in the form of sodium, potassium, calcium, silica and iron etc. The ash contents in rice straw collected from both mill was high as compared to bagasse. There was marginal difference in value of ash between the raw material obtained from the two mills. The ash content in whole bagasse was higher than depithed bagasse. The reason is that during depithing, the ash passes with the pith. The high amount of calcium and sodium in both materials could be from the fertilization through adsorption by the plant cells. The silica content, the main characteristic of agro fibre was higher in wheat straw than bagasse. Silica constitutes the major portion of the ash content, silica enters in the spent liquor during pulping and poses several problems in pulping and recovery cycles.

The hot water solubility was higher in bagasse as compared to rice straw indicating the pressure of low molecular weight carbohydrates and water-soluble extractives. Alcohol- benzene solubility as indicated of extraneous substance was also high in whole bagasse. The alcohol benzene solubility was low in case of rice straw.

One tenth normal alkali solubility showing the amount of short chain hemicellulose and probabilities of decay was higher in rice straw than bagasse. This shows that normal storage of rice straw leads to considerable deterioration of the raw material.

There was not much variation in Klason lignin content between rise straw collected from two mills. Klason lignin was higher in case of bagasse, the whole bagasse was high in lignin content than depithed bagasse. Holocellulose content in bagasse
was higher. Depithed bagasse had higher percentage of holocellulose, atmospheric conditions lead to the appreciable degradation of holocellulose.

From the result depicted in table-1 and table-2, it is clear that the raw material content form both mills did not vary much in terms of chemical composition.

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The role of Just In Time implementation on procurement performance in the Manufacturing industries, Rwanda

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Abstract- The main objective of this study was to determine the effect of Just-In-Time on the cost of procurement materials, to assess the effect of Just-In-Time on wastage of SKOL The specific objectives of this study were to find out if lead time affect SKOL Brewery’s procurement performance, to determine the influence of procurement process on performance. Data was collected from selected respondents to generalize the results of the study. The study was conducted on 31 respondents. Universal sampling techniques, questionnaires and documentation methods were used to collect data relating to this topic. The study found that lead-time has a strong positive correlation to the procurement performance and highly significant. Procurement process has a strong positive correlation to the procurement performance and significant too. Procurement professionalism has a strong positive correlation to the procurement performance. The study concluded that Just In Time implementation contribute to the procurement performance of manufacturing industries in Rwanda. The study recommends that Leadership should actively collect information about procurement and Just in time to help create new approaches, and networks among other strategies to understand the organizational environment and any signs of change.

Index Terms- Just In Time, procurement, procurement performance, manufacturing industries

I. INTRODUCTION

Public procurement is the process by which public entities contract for acquisition/supply of goods services or wants and disposal of public goods. In public procurement, a good JIT procurement system ensures that all the equipment and services required by the customers are always available for them and hence a superior service from the organization. JIT is a procurement system which is very efficient and enables the public sector to have a competitive advantage over the other but JIT procurement system has not been fully adopted and used in many organizations despite its many advantages, compared to other old methods of procurement system such as hand to mouth and speculative system (Amin, 2011).

Just in time (JIT) concept has been applied with considerable success in manufacturing environment. This research was to provide an insight of JIT concept and procurement performance in public sector. Although JIT concept has many advantages, current study suggests that its application has not been applied in total within public sectors organization. Nevertheless the essence of JIT concept in the context of procurement management can and should be explored. JIT is a broad based philosophy of management, which embraces everybody in the public sector and covers every process towards a culture of never ending or continuous improvement by removing wastes and non-value adding processes (Kinyua, 2015).

The essence of JIT is to purchase materials and the material are therein time for consumption and these materials must be of high quality to enable smooth running of the system. Procurement systems have increasingly taken a pivotal strategic role in supply-chain management. Although the strategic role of the procurement systems have not been fully subjected to rigorous theoretical and empirical scrutiny. Extensive research has remained largely unreliable and theoretically underdeveloped. Procurement systems have assumed an increasingly pivotal strategic role, evolving from an obscure buying function into a strategic business partner. Researchers have documented how strategic procurement systems actively participate in corporate planning process, facilitate beneficial organization-environment alignment and foster cross-functional integration among supply-chain activities, among other things (Kinyua, 2015). This study aims to assess the role of Just In Time (JIT) on procurement performance in public sector.

Just in time (JIT) is ‘an inventory control philosophy whose goal is to maintain just enough material in just the right place at just the right time to make just the right amount of product. Public institutions procurement is an instrument of Government policy. The setting of new policies to serve socio-economic objectives, changed working environment, and good governance require a turnaround approach in public procurement system, which is an inevitable pre-requisite for service delivery. The government needs to adopt dynamic changes to be able to govern in an efficient and effective manner in order to deliver services. Government just like any business venture has obligations and commitments to fulfill to its customers ‘the citizens’, who are claim holders and it’s duty bound to deliver on the promises made in manifestos, service charters and during performance contracting (Adagala, 2014).

II. OBJECTIVES OF THE STUDY

The main objective of this study is to determine the effect of Just-In-Time on the cost of procurement materials, to assess the effect of Just-In-Time on wastage of SKOL Brewery and to confirm the effect of lead time in the procurement process of industry manufacturing.

Specific objectives

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i. To find out if lead time affect SKOL Brewery’s procurement performance
ii. To determine the influence of procurement process on procurement performance of SKOL Brewery
iii. To establish the relationship between procurement professionalism and SKOL Brewery’s procurement performance

III. LITERATURE REVIEW

III.1. Concept on Just In Time

Just In Time found a great acceptance in developed countries such as USA, Malaysia, UK, and Canada, as well as in developing countries like Kenya. Just-in-time (JIT) is an inventory strategy companies employ to increase efficiency and decrease waste by receiving goods only as they are needed in the production process, thereby reducing inventory costs. This method requires producers to forecast demand accurately. This inventory supply system represents a shift away from the older just-in-case strategy, in which producers carried large inventories in case higher demand had to be met (Farrington, 2006).

This study describes the factors of Just In Time implementation such as lead time, procurement process and procurement professionalism.

A. Lead Time

Lead time is one of the main competitive factors among companies. The ability to deliver quickly influences export, sales and thereby revenue. The definition of lead-time can vary, depending on what part of the company is focused upon. Lead time begins with the first receipt of a customer order and ends with customer receipt of the product or service. Everything in between is the lead-time. Lead-time refers to the time lag between placing an order and receiving it. Lead time is therefore defined as the time it takes from getting order from a customer and receiving the delivered product by that customer. When the duration between the ordering period and the delivery varies from the expected time, then lead time variability occurs. Lead time variability therefore refers to the variations in lead time that can occur for purchased items and for those that are manufactured in-house (Berkowitz, M.; Mohan, K., 2014). A major factor related to these variations is quality problems. Typically, either safety stock or lead time is utilized to cushion the impact of this variability. In either case, larger variability requires increased inventories.

Lead time is the amount of time between the placement of an order and the receipts of the goods ordered. It depends on the nature of the product e.g. whether it is made to order or if it is a from the shelf product. Lead time also depends on planning and supply chain management, logistics services and of course distance to customers and suppliers. Long lead time does not need to be a problem if delivery is predictable and demand is stable. However, if there is uncertainty about future demand, long lead time is costly even when the customer knows exactly when the merchandise will arrive. If future demand has been underestimated, running out of stock has costs in terms of foregone sales and the possibility of losing customers. If future demand has been overestimated, excess supply must be sold at a discount. Furthermore, the longer the lead time and the more varieties of the product in question are on the market, the larger stocks are needed. It is also important to notice that competitiveness on lead time is not a static concept. When some firms are able to shorten lead time, others must follow in order to avoid punishment in terms of discounted prices or at worst exclusion from the bidding process. The latter can happen when a critical mass of suppliers is able to deliver just-in-time and the customer finds it safe to reduce inbound inventories to a couple of days or in some cases even a couple of hours (Beer, 2011).

B. Procurement process

Most organization use strict rules on procurement processes that must be followed by the whole organization with contract value thresholds dictating the procurement practices to be adopted. Generally, good procurement practices should be competitive, whether it be comparing quotations for low value purchases, right up to formal tender process for high risk, high value contracts. There is a number of different procurement practices choice of which depends on different firms’ policies, complexity and value of the procurements. The three most commonly used procurement processes are discussed below (CAvinito, 2002).

Request for quotations is a standard business process whose purpose is to invite suppliers into a bidding process to bid on specific goods, products or services. This procurement process is commonly used by most organizations. Procurement obtains three written, comparable quotations from any three potential suppliers. Further negotiations can be entered into with either or all of the suppliers. This process is appropriate for low value, low – medium risk procurements.

Request for proposal is an invitation for supplies, often through a bidding process, to submit a proposal on a specific commodity or service. A bidding process is one of the best methods for leveraging a company’s negotiating ability and purchasing power with suppliers. RFPs are commonly used for procurement of highly technical purchases where suppliers are expected to come up with own solution to a request. Again, companies usually request for at least three proposals from potential suppliers as stipulated by the company’s procurement policy (Amin, 2011).

Request for tenders is a structured invitation to suppliers for the supply of goods and services. RFTs are commonly used by government procurement agencies at the local, state and federal levels, and the private sector equivalent is the RFP. Under the standard tender process all requests are advertised accordingly. Where there is a strong market, many potential suppliers, a Supplier Pre-Qualifying Questionnaire (SPQQ) may be provided for interested suppliers to fill out. The SPQQs are evaluated and short listed suppliers and invited to tender for the contract. The Invitation To Tender (ITT) will usually constitute of the buyer’s service specification, buyer’s model terms and conditions of contract, tender brief, form of tender, tender brief and a cover letter with detailed tender instructions, thus the dates and times by which tender responses need be returned and evaluated, contact details of buyer representative to whom further queries should be made. Once the decision has been made all the bidders who submitted a response was notified of the decision. Tender process guiding principle is that all bidders must be treated equally, fairly and in
transparent manner. Standard tender processes take the form of open or restricted tender process as explained below (Amin, 2011).

Under the open tender procedure, all suppliers or bidders who respond to an advertisement are invited to tender, supplied with tender documentation, and in some cases a supplier questionnaire. All responses are evaluated on the same basis and contract awarded to the winning bidder. This is a two-stage approach in which the buyer invites interested suppliers to express an interest and undergo a pre-qualification assessment before being invited to tender. All submissions have to be compliant with the instructions to tenderers. Upon completion of the assessment, the suppliers are short listed and officially invited to tender for the contract. The tender responses then evaluated by a panel of evaluators and the contract awarded to the winning bidder. Commonly used in the private sector, the closed tender process has elements of the tender process and the auction process. The buyer submits written offer or bid for the goods or services and the vendor either accepts or rejects the offer. The vendor may accept the highest offer or decide to negotiate with the buyer whose tender they like best or they could reject all the tenders. This process is commonly used by real estate agencies for the sale of properties or commercial land or for sale of motor vehicles or other suitable goods and services (Amin, 2011).

C. Procurement professionalism

Are professionals conveying professionalism? Unfortunately, there’s increasing debate over this topic supported by day-to-day encounters. There’s much written about the frustrations caused by a lack of professionalism demonstrated by professionals. It’s reaching a point where there are declarations that “professionalism is dead.” This perception is reinforced by anecdotes of: ignored messages, calls not returned, being late or not showing for a meeting and the most damming--checking messages during a discussion (a.k.a. not paying attention). Hopefully, this is all just anecdotal but, it’s probably not (Amin, 2011).

Procurement professionalism means many things to me. But one of the most important components of procurement professionalism to me is confident, fast and good decision-making. Today’s procurement professional is faced with having to make many decisions. Some of them, like selecting a supplier for a long-term contract, allow for deliberate decision-making over weeks. Others, like dealing with a supply disruption in a JIT situation, require the right decision to be made immediately. And, let’s face it, the higher one goes up the corporate ladder, the more decisions there are to be made and, therefore, the quicker they need to be made. So I believe that making high quality decisions in a short amount of time is a requisite competency for success in procurement and in business (Kinyua, Benmoffat Kimathi, 2015).

III.2. Concept on procurement performance

To achieve Procurement Performance, companies have to find the right balance between agile and fast adaptation of the supplier's portfolio and the development of long term partnerships with suppliers capable of assuming a risk-sharing position (Hines, 2004). Organizational audit & diagnosis, purchasing processes definition and deployment, redesign to cost, global sourcing, suppliers qualification and integration.

Purchasing performance optimization

Clients improve their purchasing efficacy and efficiency: purchasing portfolio optimization, project purchasing, purchasing service center, training & coaching, consultancy.

Sourcing strategy

All the stakeholders from executive level must to suppliers within a change management program guaranteeing the effective transformation

Cost analysis and management

A large range of services from standardizations to redesign to cost, including make or buy, value analysis and calculation models to support design- to-cost approaches and validation at an early stage of technical options.

Purchasing professionalization - training & support

The training modules combine a practical approach based on our past experiences and business methodological material. They are dedicated both to purchasing and engineering organizations in order to raise project managers’ understanding of their project cost and negotiation leverages (Neely et al., 2015).

As part of the efforts to adopt a long term and strategic view of their procurement needs and performance, most organizations and countries have resorted to turning to their annual procurement plans as a possible ‘problem-solver.’ The combination of focusing more on collaborative relationships and the increasing strategic role of purchasing has resulted in a rise in prominence of strategies of supply base and the quest for global efficiency and effectiveness has led to increased centralization and coordination of the purchasing function (Neely et al., 2015).

Many publications and sources show that procurements arrangements are often split into two major categories – direct procurement, which is applicable to production, related settings and the second category being indirect procurement, which applies to non-production, related procurement. Direct procurement is primarily driven by contracts and plans for manufactured goods, impacted by changing demand and product configurations and determined by design factors and supplier capacities. The scope spans the design to plan to procure processes and is a critical success factor in demand driven operations. As such, direct procurement focuses in supply chain management, and affects the production process in manufacturing settings only. With indirect procurements, procured goods or services do not end up in the product or services delivered to the customer (Hines, 2004).

III.3. Research gap analysis

Many researchers studied about Just In Time (JIT) like Kinyua (2015) studied on just in time procurement system on organization performance: a case study of corn products Kenya Limited, Nyakundi and Simeon (2015) established the factors affecting the implementation of JIT inventory in public institutions in Kenya, Onyiego (2015) established the factors affecting the implementation of JIT inventory in public institutions in Kenya. No empirical study showed the role of Just in Time implementation on procurement performance in manufacturing industries. No empirical study showed the percentages of correlation between Just in Time implementation and procurement performance in manufacturing industries. There is therefore a gap in the empirical evidence available. This study seeks to bridge the gap by studying the role of Just in Time implementation on procurement performance in manufacturing industries. The study

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identifies the percentages of correlation between the Just in Time implementation and procurement performance in manufacturing industries by using Spearman correlation and multiple regression models.

III.4. Just In Time implementation and procurement performance of manufacturing firms

The proposal of implementing Just in time (JIT) practices upstream with the supply chain is possibly as old as the concept of JIT itself. Regarding the impact of JIT supply practices, many authors have the same opinion that implementation of JIT at the public supplier interface may contribute to the production planning processes, which significantly streamline procurement processes and this efficiency results in cost saving and smoothening the material flow (Quresh, 2013).

According to Mackelping (2010) revealed that JIT deliveries are positively associated with inventory from the suppliers, delivery performance and cycle time. Numerous studies have been conducted so far regarding JIT techniques in the context of Pakistan. Irfan et al. (2008) identified the problems of Pakistani firms regarding supply chain management in order to improve their overall performance and competitive positions. They found that regional level suppliers need to interact with manufacturers using JIT approach in order to enhance the effectiveness of supply chain. From the above discussion, the study post the following hypothesis i.e.,

While probing into the current scenario of automotive manufacturing industry its productivity and possible remedies to improving the productivity, Another survey study reported the benefits of JIT that include reduction in inventory, minimizing the lead time, quality improvement, and better equipment and employee utilization. Provided with the effective implementation of JIT process if not then it was difficult to get the desirable benefits (Abdi, 2015).

Improving manufacturing flexibility and decreasing in-process inventories JIT enhances reduction in lot sizes capabilities of a firm. It is essential during implementation to continuously monitor the production plans in order to recognize the importance of JIT mechanisms. JIT production process refers to the adoption of practices aiming at the reorganization of shop floor and streamlining production flows within production plants, JIT production and Internal JIT. Some of the commonly used JIT production practices involve set up time reduction, daily schedule adherence, small lot size, kanban based pull systems, cell layout (u-shaped) and heijunka boxes (Adagala, 2014).

IV. METHODOLOGY

The study adopted a descriptive research design. The target population was employees of Skol Brewery. Universal sampling techniques was used to select 31 employees. Data was obtained by use of closed ended questionnaire and was analysed for descriptive and inferential statistics. Correlation coefficient was used to determine the relationship between 2 variables

V. RESULTS AND FINDINGS

The major findings on the Just In Time implementation and procurement performance in manufacturing industry in Rwanda.

i. Findings on the effect of lead time on procurement performance of Skol Brewery Ltd

The evidences form table 1 indicated that lead-time has a strong positive correlation to the procurement performance of Skol Brewery Ltd equal to 0.816** and the sig. is .001 which is less than 0.01. When sig. is less than significant level, thereafter researcher concludes that variables are correlated and the null hypothesis is rejected in favor of alternative, this leads to confirm that there is significant relationship between lead-time and procurement performance of Skol Brewery Ltd. It is therefore concluded by the researcher that there is a statistically significant correlation between lead-time and procurement performance of Skol Brewery Ltd.

ii. Findings the influence of procurement process on procurement performance of Skol Brewery Ltd

Procurement process has a strong positive correlation to the procurement performance of Skol Brewery Ltd equal to .786** and the sig. is .001 which is less than 0.01. When sig. is less than significant level, thereafter researcher concludes that variables are correlated and the null hypothesis is rejected in favor of alternative, this leads to confirm that there is significant relationship between procurement process and procurement performance of Skol Brewery Ltd. It is therefore concluded by the researcher that there is a statistically significant correlation between procurement process and procurement performance of Skol Brewery Ltd.

Findings the influence of procurement process on procurement performance of Skol Brewery Ltd

Procurement professionalism has a strong positive correlation to the procurement performance of Skol Brewery Ltd equal to .816** and the sig. is .000 which is less than 0.01. When sig. is less than significant level, thereafter researcher concludes that variables are correlated and the null hypothesis is rejected in favor of alternative, this leads to confirm that there is significant relationship between procurement professionalism and procurement performance of Skol Brewery Ltd. It is therefore concluded by the researcher that there is a statistically significant correlation between procurement professionalism and procurement performance of Skol Brewery Ltd.

Source: Author, 2020

VI. CONCLUSION AND RECOMMENDATIONS

The main purpose of this study was to find out the relationship between Just in Time implementation and procurement performance of manufacturing industries in Rwanda, a case study of Skol Brewery Ltd. The study concluded that Just In Time implementation contribute to the procurement performance of manufacturing industries in Rwanda. There is relationship between Just in Time implementation (lead time, procurement process and procurement professionalism) and procurement performance of manufacturing industries. On the basis of the conclusion the study recommends that organizations collect
information about procurement and Just in time and create a network of listening systems, among other strategies to understand and update organizational procurement environment.

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What is graphene?

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Abstract: Graphene is a monolayer of carbon allotrope that has honeycomb connections. The scientists have brought graphene to their focus. A large amount of scientific paper has already been written related to this issue. In this paper, I try to write a simple review of graphene and discuss it. I will focus on main concepts of graphene such as history, prospective of graphene, its grandeur, properties (including its optical, electronic, and mechanical properties) of graphene, its economic landscape, and finally the defection of graphene and its impact on semiconductors and mechanical behavior of graphene will be discussed.

Keywords: carbon, graphite, graphene, grandeur, defect

Introduction

Carbon is one of the most useful elements in the world that makes all basis of organic chemistry. Carbon has different physical properties and these properties are related to its dimensionality. Graphene is one of the most famous carbon allotropes that role a key point in electronic properties. Graphene has a carbon honeycomb structure and it looks hexagonal in shape (A. H. Castro Neto f. G., 2009). The atomic thickness of graphene is 0.345 nm and it is the thinnest and strongest materials in the universe until now. We can say that graphene is a million times thinner than a human hair but 200 times stronger than steel and it is harder than diamond. It has optical, electrical, mechanical, and thermal properties.

Figure 1. Graphene (top left) is a honeycomb lattice of carbon atoms. Graphite (top right) can be viewed as a stack of graphene layers. Carbon nanotubes are rolled-up cylinders of graphene (bottom left). Fullerenes (C_{60}) are molecules consisting of wrapped graphene by the introduction of pentagons on the hexagonal lattice (A. H. Castro Neto F. G., 2009).

The above figure shows us a different type of graphene. We can say about 2D materials including graphene that they are single atomic crystals, where 100 layers of them make a thin film of 3D materials. Finally, we can say that graphene is the mother of most carbon allotropes.

History of graphene

The earlier attempt to isolate graphene concentrated on chemical exfoliation and graphene separated by its layers intervening of atoms and molecules (Novoselov, 2009). Graphite oxide thermally has a high lamellar structure where it focused by Benjamin Collins Brodie in 1859. Graphene is made out of carbon atoms that have a honeycomb structure where it made from hexagons graphite, a three-dimensional 3D allotrope of carbon, became widely known after the invention of the pencil in 1564. Graphene was invented from graphite after 440 years since graphite inventions. Indeed, when a person wants to press a pencil to a piece of paper. In fact, he made graphene by his hand. The first person who wrote about the graphene band structure in 1964 was P. R. Wallace and he showed the unusual behavior semi-metallic of this material (A. H. Castro Neto F. G., 2009). The first stable graphene was demonstrated by Novosolev from Manchester University in 2004 and two years later the first graphene products released in 2006 by Princeton University with the cooperation of Vorbeck Materials. Vorinks became the first screen-printable graphene ink in the world (Hasan, 2018).

The Prospects of Graphene

Graphene is wildly used by researchers in the lab every day and there is a lot of paper that publish in this direction and all of them focus on different usages of graphene in the electronic equipment, economy, and bioscience and commercial market. We never forget that there is a lot of project around the world which they focus on graphene and its structure that will use in the many parts of technology and it will pave the way for good and luxurious life to the mankind in the next days.

We know more about atomic plane materials because of its bulk crystals but we don’t know about graphene and its one
atomic thick material until 2004. We can make 2D crystals by two principles. In the first method, we can mechanically split strong layered materials into a small individual atomic plane. In the second principle instead of cleaving graphite, we use an automatic method of employing, for example, ultrasonic cleaving. So, we can make by second principle polycrystalline films and composite materials.

The studies of electronic properties of graphene focus on Dirac equation with some standard formalism of condensed matter to gain new physics so, these study of graphene led us to half-integer quantum Hall effect (QHE) and predict some phenomena like Klein tunneling, zitterbewegung, Schwinger production, supercritical atomic collapse and Casimir-like interactions between adsorbates on graphene (Geim, 2009).

Grandeur of Graphene

Graphene changes all the earlier landscapes with its unimaginable structure and shows that it has less speculative applications. As we look at graphene development in recent years, it will take place instead of Si in the electronic materials and will change most of our world landscapes in the next few years. Graphene has many usages in a different section of technology. For example, in the transmission electron microscopy (TEM). Graphene will offer a good possibility to extend high electron mobility transistors (HEMT) that has high usage in communication technologies (Geim, 2009).

At the end of graphene grandeur, I would like to say that recent studies about the graphene structure suggest to us about production cost of graphene sheets in large quantities that would be much lower than carbon nanotubes (Kaner, 2008).

Graphene properties

Carbon shows a lot of structures and a large number of different properties because of its flexibility bonding. Graphene has different properties like optical properties, electrical properties, and mechanical properties. In the first part of this section, I would like to focus on the optical properties of graphene and then I will explain the other parts.

The optical conductivity of graphene is constant and it is independent of energy. So, we can easily derive that optical conductivity is also independent of any parameters. The optical conductivity is very close to DC conductivity but it is not equal.

The optical properties of graphene are experimentally and theoretically depending on its local strain.

Graphene is a promising material with low resistance that use in many applications like touch screen, liquid crystal displays, organic light-emitting diodes, solar cell, computer. Also, it is not imaginative to say that we will use in the future graphene and graphene oxide in other optical equipment where it will change our lives in many aspects that we had problems in recent years. Graphene has a very large Faraday rotation about 6 degrees and this specialty allows us to use it in magneto-optical devices (A. N. Grigorenko).

Second, the structure of flexibility reflects on graphene electronic properties. According to the graphene structure, the first Brillion zone (BZ) has two inequivalent Dirac point $k$ and $k'$ where the band crossing occurs there.

The charge carrier properties of graphene explain that graphene is zero-gap 2D semimetal carbon allotropes which have tiny overlap between valence and conductance and its charge carrier move under some condition (Xiao Huang, 2010).

Figure 2. Schematics of the crystal structure, Brillouin zone, and dispersion spectrum of graphene

Graphene ambipolar field effect and charge carriers can tune in both electrons and holes that show in Figure 3.

Figure 3. Ambipolar electric field effect in monolayer graphene. The insets show that the changes in the position of the Fermi energy $E_F$ with changing gate voltage $V_g$.

The mobility in graphene tells us about high carrier density in electrically and chemically doped devices and the electronic properties of graphene also explain the quantum hall effect (QHE) at room temperature.

Third, the mechanical properties of graphene include Young’s modulus and fracture strength study by molecular dynamics. The Youngs modulus experimentally investigates with force-displacement by atomic force microscopic (AFM) on graphene tranches. Also, the elastic properties of graphene were measured by nanoindentation by using an (AFM) in recent years (By Yanwu Zhu, 2010).
The application of graphene in the oil and gas industry use just for a few years. Graphene application in oil and gas industries can use in many sections like drilling, lubrication, de-salination, anti-corrosion coatings, cement-ing, oil-water separation, oil spill cleanup, and emulsion (Neil Neuberger, 2018).

Graphene is used in the water filtration system for purification of water as it allows water to pass through the system, not other liquids and gases. It is also in medical sensors, drug delivery, and cancer therapy. However, its toxicity profile must investigate before clinical use.

Graphene has a good potential to use as a replacement of indium tin oxide in LCD panels and also it can also use in other sections like ultracapacitors for energy storage and nanoelectromechanical systems (Meindl, 2009).

Li-ion battery is the bone of handheld devices like telephone and day by day it requires more ability and has strong characteristics (Minghui Liang, 2009). To make stronger batteries we need good materials that have good stability. So, we use graphene-based materials to make good anode Li-ion batteries because, it has super electrical conductivity, high surface area, and chemical tolerance (Wonbong Choi, 2010).

Graphene improves batteries like faster charging, high energy output, high cycle times, and larger lifetime.

Graphene also uses in other sections such as sea-water desalination, preparation of pure and ultra-pure water, biomedicine, biology, environmental protection and many others section that are important in our lives and this extensive usage of graphene predict that graphene and graphene oxide will play a good role in technology and economy (Na Song, 2018).

The economic landscape of graphene
The graphene market is not as much developed as other materials. The total size of graphene global marked including its applications and manufacturers were USD 24.5 million in 2015 but this change in 2020 and the size of the graphene market take a higher place of about USD 126 million.

Figure 5. Show projected growth of the worldwide graphene industry from 2015 up to 2020 (Hu, Yang, & Hasan, 2019).

To understand the amount of investment for graphene manufacture around the world, look at the diagram in figure 6.
Figure 6. Graphene production capacities in 2015 (Hu, Yang, & Hasan, 2019).

The Asia Pacific is the fastest and largest area for graphene investment among other countries, this is because of being the large raw graphite capacity of China. The growth of the graphene industry in Europe is now related to some researches in the universities. For example, the UK government invested GBP 100 million at the University of Manchester and GBP 20 million at the University of Cambridge. The European Union investigate Euro 1 billion for 10 years since 2011 for the project of “Graphene Flagship Program” to understand and permute graphene and related 2D materials. The graphene market was USD 8.75 million in 2016 and reached USD 38.5 million by 2020 (Hu, Yang, & Hasan, 2019).

Graphene defects

According to the second law of thermodynamics, there are a few disorders in crystalline materials, and such defects influence the properties of some materials. This defect can see in semiconductors or mechanical properties of some metals. Several experiments show that there are some native or physical defects in graphene. We can show the defects of graphene by using transmission electron microscopy (TEM) and scanning tunneling microscopy (STM) methods. The intrinsic defects of materials have different dimensionality. Graphene material lattice can reconstruct by forming nonhexag-onal rings and this explains that simple defects in any materials especially in graphene materials are missing atom of its structure. Scientists can observe single vacancies (SV) of graphene materials experimentally by TEM and STM methods.

Double vacancies (DV) occur by merging two SV or missing two atoms in graphene structure as shown in figure 8 in the below picture. If graphene misses more than two DV through some methods then it will lead us to more defect configurations. If occur missing a large number of atoms from a small area due to the impact of ions, that time a reconstruction will require because of area surface reduction. One dimensional defect occurs during the study of some experimental work of graphene. In fact, the line defect occurs when we want to separate two domains of lattice orientations with tilt axis to plane.

Figure 7. Single vacancy. As seen in an experimental TEM image (Florian Banhart, 2011).

Figure 8. Atomic structures of reconstructed double vacancy defects in graphene as obtained from our DFT calculations (Florian Banhart, 2011).

Line defect frequently divided domain of different crystal orientation as shown in figure 9. Also, we can say that this defect is a line of reconstructed point with or without dangling bands.
Figure 9. Line defect formation from aligned vacancy structures (Florian Banhart, 2011).

Defects of graphene strongly affect electronic properties and it will change the situation of the electronic structure of graphene. We are at the beginning study of graphene electronic properties and it will take time and need more experiments that show how much will this defect is on graphene electronic properties (Florian Banhart, 2011). The tuning properties of graphene can be realized by several methods. For example, particle irradiation, thermal annealing, chemical reaction, and strain treatment (Gao Yang, 2018).

Conclusion
Graphene is a single monolayer carbon atom that arranges by a hexagonal lattice. It is carbon allotrope was extracted by Novoselov in 2004 at the University of Manchester. It is the thinnest and strongest material that has ever been discovered until now. It has a multi-field different electrical, optical and mechanical properties that attracted the scientists and expert's attention. Some world markets also have invested a big amount of money to develop some new unique products by utilizing the different specifications of graphene. From a mechanical point of view, it has the most strength and flexibility amongst most of the materials that have ever been discovered or as a manmade product found. This item also has shown the most electrical flexibility and conductivity. It also has properties of stretching of up to 20%.

Graphene has also high electrical current density millions of times than copper. The graphene's intrinsic mobility is 100 times that of silicon. It can be used in many ways like water purring, bioscience, nanotube, nanotechnology, and many other fields. It will take no longer that we produce and manufacture good equipment and products such as phones, computers, watches, nanomaterial and machinery, advanced model vehicles, and even supercapacitors using graphene and graphene batteries. We will prefer graphene and graphene oxide to other materials in the next generation of technology because of its good structures, multipurpose properties, and high flexibility. Now we are identifying the detailed structure and properties of graphene. In some cases we make some equipment applying graphene, but if we want to utilize much more from graphene materials and apply graphene to our products, let’s wait no longer than a few years. Some projects are running on concentrating on graphene such as the “graphene flagship of Europe” that has a one billion budget. Passing time it will be more clear for us how graphene will change the industry and upcoming technology.

References


An Analysis of the Indonesian Insurance Company's Financial Performance

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Abstract- Through financial reports, the insurance company can determine the exact steps the company is taking now and in the future, by looking at the various problems that exist, both the weaknesses and the strengths it has. The data analysis method used in this research is to use quantitative methods with horizontal analysis of the financial statements of PT. Bhakti Bhayangkara based on Statement of Financial Accounting Standards (PSAK) No. 28 concerning Loss Insurance Accounting, namely Solvency and Profitability Ratio, Liquidity Ratio, Premium Stability Ratio and Technical Ratio. Based on the data analysis conducted, it is concluded that the company’s financial performance is in good condition when viewed from several ratios, but there are also records that need to pay attention to several ratios, such as the need for evaluation in calculating rates, good claims management, and insurance contracts. This is intended so that the insurance company's underwriting expense does not increase and affects the underwriting results and so on. With this step, it is hoped that in the future good decisions can be produced and can improve the company's financial performance.

Index Terms- Accounting, Loss Insurance, Financial Statements, Company Performance, Underwriting

I. INTRODUCTION

Insurance is a company that transfers risks that come from individuals to institutions that bear the risk. Insurance companies collect large enough funds where these funds are the result of financial management and these funds are used for company operational activities. Apart from operational activities, financial statements are also a factor in assessing company performance.

In terms of financial report, it is the obligation of every company to make and report its company finances for a certain period. What is done is then analyzed so that the current condition and position of the company can be found. Then the financial statements will also determine what steps the company will take now and in the future, by looking at the various problems that exist, both weaknesses and strengths. Good profit growth implies that the company has good finances, which in turn will increase firm value, because the amount of dividends to be paid in the future is highly dependent on the condition of the company [1]. In addition, company managers often need additional internal information that may differ from official financial reporting [2].

Until now, there have been 5 (five) large insurance companies that have closed due to poor financial performance. The definition of financial performance is the determination of certain measures that can measure the success of an organization or company in generating profits [3]. Meanwhile, financial performance is the company's ability to manage and control its resources [4]. Financial statement analysis needs to be carried out carefully by using appropriate analytical methods and techniques so that the expected results are absolutely correct. Errors in entering numbers or formulas will result in inaccurate results to be achieved. Then, the results of these calculations are analyzed and interpreted so that the real financial position is known. All of this must be done carefully, deeply and well. This study chooses an object in the insurance sector because insurance companies have experienced positive developments. Insurance industry stands as a service business that plays a significant role in Indonesia economical condition [5]. According to data from the Financial Services Authority, the total profit generated by general insurance companies in December 2018 was IDR 4,468 trillion while in December 2019 it was IDR 7,083 trillion.

Based on the explanation background, the subject matter to be discussed in this study is how the financial performance of the Bhakti Bhayangkara Insurance company based on financial ratio. Financial ratio analysis is an analysis by comparing one report item with other financial statement items, either individually or collectively in order to find out the relationship between certain items, both on the balance sheet and in the income statement [6]. According to the Statement of Financial Accounting Standards (PSAK) No. 28 regarding Insurance for Loss Accounting, there are several financial ratios used to analyze the performance of insurance companies which can be classified into four aspect ratios, namely Solvency and Profitability Ratio, Liquidity Ratio, Premium Stability Ratio, Technical Ratio. In addition, financial analysis, especially in an insurance company, is used by actuaries in the process of making decisions on insurance company investment and underwriting activities [7].

In practice, although the financial ratios used have quite a number of functions and uses for the company, it does not mean that the financial ratios that are made represent the real financial condition and position, because the financial ratios used have many weaknesses. Even with the results of the ratio obtained, at least a picture can be produced as if it actually happened. Weston (2014) mentioned the weaknesses of financial ratios are (1)
financial data is compiled from accounting data [8]. Then the data is interpreted in various ways.

II. METHODOLOGY

The data used in this study is secondary data obtained from the annual financial statements of PT. Asuransi Bhakti Bhayangkara for the period 2015 - 2018. The data analysis method used in this research is to use quantitative methods with analysis of the financial statements of PT. Bhakti Bhayangkara based on Statement of Financial Accounting Standards No. 28 concerning Loss Insurance Accounting, namely Solvency and Profitability Ratio, Liquidity Ratio, Premium Stability Ratio and Technical Ratio.

Solvency and profitability ratio, consisting of:

\[ \text{Solvency Ratio} = \frac{\text{Shareholder Fund}}{\text{Premium Netto}} \]

Underwriting Ratio = \frac{\text{Underwriting Results}}{\text{Premium Income}}

Loss Ratio = \frac{\text{Claims Amount}}{\text{Premium Income}}

Commission Expense Ratio = \frac{\text{Commission Amount}}{\text{Premium Income}}

Investment yield Ratio = \frac{\text{Investment Income}}{\text{Investment Average}}

Liquidity ratio, consisting of:

Liability to Liquid Assets Ratio = \frac{\text{Liabilities}}{\text{Admitted Asset}}

Premium Receivable to Surplus Ratio = \frac{\text{premium accounts receivable}}{\text{Surplus}}

Investment to Technical Reserve Ratio = \frac{\text{Investment Amount}}{\text{Technical Obligations}}

Premium stability ratio, consisting of:

Net Premium Growth = \frac{\text{Decrease / Increase in Net Premium}}{\text{Last Year’s Net Premium}}

Own Retention Ratio = \frac{\text{Net Premium}}{\text{Gross Premium}}

Technical Ratio, consisting of:

Technical Ratio = \frac{\text{Technical Obligations}}{\text{Net Premium}}

Technial Reserve Ratio = \frac{\text{Technical Obligations}}{\text{Net Premium}}

III. RESULT AND DISCUSSION

Characteristics of Loss Insurance Accounting

Loss insurance is essentially a system of protection against the risk of financial loss, by transferring risks to other parties, either individually or as a group in society. Classified into loss insurance, among others, Fire Insurance, Transportation Insurance, Motor Vehicle Insurance, Marine Ship Frame Insurance, Air Ship Frame Insurance, Engineering Insurance and Miscellaneous Insurance such as personal accident insurance, securities shipping and storage insurance, and others. other.

The general insurance business has different characteristics and characteristics from other types of business in the service sector, because the insurance business takes over various risks from other parties so that the insurance company becomes risk intensive if it is not managed properly. In addition, insurance companies are also full of information with a variety of information that must be processed for underwriting, financial and other decisions. The basis of the insurance business is public trust, especially in terms of the company's financial capacity to meet its claims and other obligations on time. For this reason, the insurance business must be managed professionally, both in risk management and in financial management.

Based on Statement of Financial Accounting Standards No. 28 some of the characteristics of the accounting for loss insurance companies include: The liability of a large insurance company to the insured affects the presentation of financial statements, especially the balance sheet. The determination of expenses cannot be fully related to premium income, because the incidence of claim expenses does not always coincide with the recognition of premium income. The income statement is strongly influenced by elements of estimation, for example: an estimate of the amount of unearned premium income and an estimate of the amount of claims incurred in the current period (an estimate of self-dependent claims). Insurance companies must meet government regulations in terms of the solvency margin.

Relationship between Financial Ratios and Financial Performance

According to James C. Van Horne and John M. Wachowicz (1995) that: To evaluate the financial condition and performance of a firm, the financial analyst needs a certain yardstick. The yardstick frequently used is a ratio, index, relating two pieces of financial data of each other [9]. So to assess the financial condition and performance of the company, a ratio can be used which is a comparison of the numbers contained in financial statement posts.

From the above opinion it can be understood that financial ratios and financial performance have a close relationship. There are many financial ratios and each of these ratios has its own use. Because we cannot analyze the whole formula, it is suitable in all cases studied. Or in terms of financial experts that the market is the best laboratory for testing all capabilities and analysis that is owned, then all formula ownership and various thoughts that we have will be proven when testing on the market, such as profit or loss that will occur later.

The purpose of this ratio is to determine the level of the company's financial capacity to bear the risks covered. The results of this ratio can show how much the company's financial ability to support the risks that may arise from the insurance it covers. This ratio proves that the higher the results obtained, the insurance company does not need to worry if there is a large amount of insurance coverage.

According to Figure 1 solvency ratio of PT. Bhakti Bhayangkara has decreased, indicating that the company's finances are still unable to bear high risks due to high premiums, in other words, the higher the premiums, the higher the risk that must be borne. If there is a large number of insurance claims, it is feared that the insurance company will not be able to pay the benefits that have been promised. If this is not balanced with an increase in equity, in this case shareholder funds, the company will experience financial difficulties in bearing the risks that are closed.

Further analysis is needed in determining the problem of excess closure that is not proportional to the company's financial capacity. Things that have to be analyzed; stability of company underwriting profit, premium distribution, adequacy level of reinsurance protection, distribution and variation in investment value.

Underwriting income is income obtained from the main activities of an insurance company. The main activity in question is the premium obtained from various marketed products, with claims closed by the insurance company. This ratio shows the level of underwriting results obtained and is used to measure the level of profit from the loss insurance business. If positive results are found from this ratio, the insurance company will benefit from the underwriting results, one of which is from an increase in premiums. If the result of this ratio is negative, it means that the coverage rate charged is too high and the number of claims has occurred. If the insurance coverage rate is too high it can cause an imbalance between the premiums earned and the underwriting expense. If this happens, it is necessary to evaluate the rate calculation, claim management, and insurance contracts, so that the underwriting expense of the insurance company does not increase and affects the underwriting results.

According to Figure 2 underwriting Ratio PT. Bhakti Bhayangkara Insurance experienced an increase in 2016 due to the increase in premiums received and moving down in the following year. This decrease was due to an increase in the amount of premium income that was not offset by the increase in underwriting results. This happened because of the increase in claims from the 2015 - 2018 period. So that PT. Asuransi Bhayangkara needs to carry out risk management to minimize underwriting expenses. One of them is by doing good claims management.

This ratio shows the claim experience that occurs in the company and measures the quality of insurance coverage. Measuring the quality of insurance in this case is in accordance with good and correct standard procedures. This ratio compares the number of claims that occur with premium income. The high loss ratio provides information on underwriting errors and insurance coverage against risks.

Loss ratio of PT. Bhakti Bhayangkara Insurance seen from Figure 3 has increased every year due to the increasing number of claims that have occurred, but this has not been matched by an increase in premium income each year.

In order to limit the increase in the number of claims, in this case the insurance company must be able and willing to develop sound and correct claims management principles that do not harm the insured. The stated claim procedure must also be effective and efficient, in addition to being able to carry out cost containment. The insurance company must provide clear guidelines and instructions regarding the claim procedure for each insured. If the claim procedure is not good, it will make the company financial difficulties.
This ratio can be used to measure the cost of the acquisition, it can also be used as a comparison of the company's commission income with other companies and vice versa. Acquisition fee is the cost of the policy that will be charged by the insurance company to the customer when buying a life insurance policy to obtain policy facilities, this fee is generally used to finance the company's operations and includes paying agent commissions. High ratio means high acquisition costs. According to Figure 4 value of commission expense ratio of PT. Bhakti Bhayangkara Insurance in fluctuating conditions every year.

The same analysis is required in other insurance companies to determine the comparison of the Commission Expense Ratio of PT. Asuransi Bhakti Bhayangkara, so that it can be assessed whether the acquisition costs and agent commission of this company have competitive results.

The investment return ratio provides an indication, in general, of the quality of each type of investment and measures the results achieved from the investment made. This ratio calculates the net investment income with the average investment from 2015 - 2018. The higher the investment ratio obtained, it shows that the company is able to manage investments well.

Investment Yield Ratio Value of PT. Bhakti Bhayangkara Insurance in fluctuating conditions based on Figure 5. In 2017, it received minus results because the company's investment return was below the average investment return for the 2015-2018 period. This is not very influential as long as the company has met the minimum solvency level of at least 120% based on POJK No.71 / POJK.05 / 2016 article 3 paragraph 1. Low ratios can provide information that the investment is not right, so that investment placement is necessary.

Care is needed in placing investments, if the company has problems with investing it will be difficult to bear obligations to the insured, and vice versa, if the company is able to place and manage investments properly, the company will be able to fulfill its obligations.

This ratio measures the company's ability to meet its obligations, which roughly describes the company's financial condition. PT. Bhakti Bhayangkara Insurance shows that the company is able to fulfill its obligations and the company is in a solvent condition seen from Figure 6. Even though it experienced a decline in 2016 compared to the previous year, the company was still within the limits set by the Financial Services Authority.

The low ratio indicates a liquidity problem and the company may not be solvent. According to National Regulation POJK No.71//POJK.05//2016, the level of solvency is at least 120% of the Risk Based Minimum Capital. Calculation of Risk Based Minimum Capital as referred to must take into account the risks that at least consist of credit risk, liquidity risk, market risk, insurance risk and operational risk. If this is the case, an analysis of the level of technical liability, distribution of assets, assessment of the stability and liquidity of the permitted assets must be carried out.

This ratio shows the extent to which the premium bill can be relied upon in supporting the surplus. This ratio calculates the unpaid receivables by the insurance company. This is important because the premium bill of individual premiums is usually difficult to expect to be withdrawn when the insurance company faces financial difficulties.

Premium Receivable to Surplus Ratio fluctuates according to Figure 7, so that PT. Asuransi Bhakti Bhayangkara may experience difficulties in collecting individual premium bills, because the higher this ratio the higher the premium bill, which is difficult to collect when there is financial difficulty. For this reason, companies need to innovate billing and premium
payments to make it easier for policyholders, especially individuals, to make payments.

Figure 8. Investment to Technical (%)

Technical reserve or technical liability here is a premium that is not yet an income plus an estimated own dependent claim. This ratio shows to what extent the technical liabilities created by the insurance company are reflected in the investment. In other words, this ratio assesses how far the company is able to cover the risk of technical liabilities without the involvement of the reinsurer by only relying on investment income. Investment to Technical Reserve or technical liability here is a premium that is not yet an income plus an estimated own dependent claim.

This ratio shows to what extent the technical liabilities created by the insurance company are reflected in the investment. In other words, this ratio assesses how far the company is able to cover the risk of technical liabilities without the involvement of the reinsurer by only relying on investment income. Investment to Technical Reserve or technical liability here is a premium that is not yet an income plus an estimated own dependent claim.

The low ratio indicates a tendency that the estimated own dependent claims are not supported by adequate funds, for this reason companies need to consolidate with reinsurance in order to minimize the estimation of their own dependent claims.

Figure 9. Net Premium Growth (%)

This ratio calculates the stability of the company as seen from the increase or decrease in net premiums generated with the previous year's net premiums. If there is a significant increase or decrease in net premium volume, this indicates a lack of stability in the company's operations.

According to Figure 9 net premium growth PT. Bhakti Bhayangkara Insurance has decreased from 2015 to 2017. This is due to the increase in net premiums which have decreased less, it can be seen that in 2017 the increase in net premiums was only 2 billion from the previous year. With a small increase in net premium income, if the company experienced an increase in underwriting expenses and operating expenses, it would later experience losses. For this reason, companies need to increase operational stability by minimizing cash flow management.

Figure 10. Own Retention (%)

This ratio is useful for measuring the company's retention rate which can later be used as a basis for comparing the company's actual capabilities with available funds. Own Retention Ratio PT. Bhakti Bhayangkara Insurance in stable condition seen from Figure 10. This condition is influenced by an increase in the amount of gross premium which can be offset by an increase in net premium. We recommend that this ratio be used in conjunction with the solvency margin, so that the analysis will describe the situation more accurately.

Figure 11. Technical Ratio (%)

The ratio of technical reserves consists of two, namely premium reserves which are not yet income and reserves for self-dependent claims. This ratio can roughly measure the adequacy level of the technical liabilities required to face the obligations arising from risk closure.

From Figure 11 technical reserve Ratio PT. Asuransi Bhakti Bhayangkara shows that sufficient technical liability funds make the company's financial condition at a solvency level with an average achievement ratio from 2015-2018 of 468.95%. This is in accordance with the provisions of article 3 paragraph 1, 2, 3 POJK No.71 / POJK.05 / 2016, namely the ratio of achieving a solvency level of at least 100% with an internal target of at least 120% of the Risk Based Minimum Capital.

IV. CONCLUSION

In the Solvency And Profitability Ratio group, the financial performance of PT. Asuransi Bhakti Bhayangkara from 2015 to 2018 shows a decline which is reflected in the Solvency Ratio. It can be seen that the insurance company finances have problems in bearing high risk due to high premiums. Loss Ratio
has increased due to increasing claims every year. The underwriting ratio has decreased due to an increase in the amount of premium income which was not matched by an increase in claims results. The Investment Yield Ratio in 2017 received minus results because the company's investment return was below the average investment return for the 2015-2018 period.

In the Liquidity Ratio group, namely the Premium Receivable to Surplus Ratio, fluctuated, so that PT. Bhakti Bhayangkara Insurance may experience difficulties in collecting individual premium bills. Investment to technical fluctuates. This condition can be said that the insurance company is still having difficulty in closing insurance without a reinsurance party, but the insurance company is quite capable of carrying out every type of investment made. However, if seen from the Liability to Liquid Assets Ratio, the insurance company is quite capable of fulfilling its obligations. The results of the performance of the Premium Stability Ratio Group, namely Net Premium Growth, indicate that the lack of operational stability in the insurance company is shown in a sharp decline on the graph due to the lack of increase in net premiums from year to year. Own retention ratio on the graph shows a stable condition. While technical ratio in stable condition. This condition can be seen that the insurance company is able to manage the funds used to pay obligations in the future.

V. RECOMMENDATION

The need for the company to provide a limit on the amount of coverage it has on its insurance products. This is so that the company can minimize the risk of default at the time of insurance closing.

There needs to be an evaluation in calculating rates, good claims management, and insurance contracts. This is so that the insurance company's underwriting expense does not increase and affects the underwriting results.

Innovation of individual premium payment collection and payment processes, in order to increase premium income and make it easier for participants to make payments, for example in collaboration with digital payments.

Companies need to increase operational stability by managing cash flow efficiently, so that operating expenses can be reduced and increase company profits.

In terms of making decisions on the financial ratio analysis, the company must have a deep understanding and prudential principles in every decision making process. Because financial ratio analysis can only be used as a preliminary warning and not a final conclusion.

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Professional’s Opinion on the 4th Industrial Revolution Readiness in Tanzania

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Abstract- This study was conducted to find out the opinion of Tanzanian professionals on the fourth industrial revolution (4IR) readiness. It was pushed by the fact that the 4IR is seen to have great advantages in the world but the pace at which Tanzania is adopting its use and enjoying the benefits is seen to be very slow. This made the researcher question professionals on the countries readiness as they are on the front line in adopting the technology. The research design used was descriptive research design and both primary and secondary data was collected. A total of 170 professionals from 25 different professions responded to an online questioner which allowed descriptive analysis to be conducted on the collected data. Findings of the study indicated that majority of the professionals are aware of the fourth industrial revolution and they think Tanzania is ready for it. The study also revealed that the fourth industrial revolution technologies simplify processes and increase production hence it has more advantages than disadvantages. On the other hand, other findings indicated that new skills are required so as to enjoy the full benefits of the industrial revolution. Finally, the study recommends more awareness campaigns on the fourth industrial revolution and modifications on the education system so that it can accommodate these technologies. This should go in line with improvements in research and development as well as review of policies and regulations.

Index Terms- Fourth Industrial Revolution, 4IR, Professionals, Tanzania.

I. INTRODUCTION

Today’s generation is witnessing massive changes in technology, changes that would have been imaginary in the past ten year (PwC, 2019). These changes bring up a new phase in human evolution as it has impact socially, economically, biologically and even spiritually (Clark, 2007). These changes are a continuation of historical changes that are commonly referred to as industrial revolutions. These revolutions are now in the fourth phase commonly referred to as the Fourth Industrial Revolution (4IR). According to Schwab (2016) the 4IR is a Technological revolution that is blurring the lines between the physical, digital and biological sphere. This revolution presents both opportunities and challenges to global leaders which conveys both hope and ambiguity (Deloitte, 2018).

Being the fourth in the Industrial revolutions (Dallal, 2019), the 4IR was presided by the first, second and third industrial revolutions (Oosthuizen, 2016). These revolutions are characterized by their ability to transform economies, jobs and even societies through the introduction of new technologies and processes (Sony, 2018). In the first industrial revolution steam engines where discovered (Mukwawaya etal 2018). Likewise, in the second industrial revolution electricity and assembly line made mass production possible which resulted into significant economic development. Finally, the third industrial revolution was enabled by advances in computing (Basl and Doucek, 2019).

More advancements in the third industrial revolution resulted into the birth of the 4IR (Arcane Research, 2020). Different from other industrial revolutions, the 4IR is characterized by the fusion between digital, physical and biological features impacting all disciplines, economies and industries (Cunningham, 2019). It is also seen as a transformation that does not change what we do but it changes human kind. Further, the third and the fourth industrial revolutions are seen to be similar but the main difference is the merging of technology and the human life seen in the 4IR (Schwab, 2016). Moreover, technological changes are happening faster than ever not leaving behind social, political and economic transformations. In addition, the 4IR has direct implications on value creation, business models, work organization and other supportive downstream processes. This means as much as the revolution affects the whole society creating new and future jobs, professionals are on the fore front (Maude, 2017).

Professionals are people who are engaged or qualified in a certain profession (Oxford Learners Dictionary, 2020). Whereas, a profession is a paid occupation, especially one that involves prolonged training and formal qualifications (Oxford Learners Dictionary, 2020). The 4IR has brought significant shift in many professions. This is because the revolution brings together human (social) and technological (technical) dimensions which has resulted into increased interaction and interconnectedness of man and machine (Basl and Doucek, 2019). With the connectedness various countries in the world are taking advantage of the 4IR to improve their social and economic wellbeing through the transformation towards smart societies (Mohanty, 2016). In one way or the other, Tanzania is one of the counties that has started taking advantage of the benefits of the 4IR. In a way, we witness the use of the term smart city in the reconstruction of big cities, Artificial Intelligence (AI) in popular in some areas and Internet
of Things (IoT) continue to spread in many application areas (Sahara Ventures, 2019 b). Although this is the case the pace at which Tanzania is adopting the use of 4IR benefits is seen to be very slow. Most professionals are yet to see the benefits of the revolution to fully employ them in their day to day operational and production activities. This was the reason that motivated the study in finding out professionals’ opinion on the 4IR readiness in Tanzania. In finding out professionals’ opinion, the study looked into various areas that signify readiness. This included the professional’s awareness of the 4IR revolution and professional’s opinion on issues relevant towards the revolution’s readiness in Tanzania.

II. LITERATURE REVIEW

The Fourth Industrial Revolution

Various researchers in the world have written on industrial revolutions. These revolutions are the ones bringing about transformations in economy, democracy and development in general (Homer and Sloan, 1982). In the previous revolutions much was seen but the revolutions did not touch all aspects of human lives (Schwab, 2016). Most of the revolutions affected production and economic aspects of life differing from to date where social life is affected along with the production and economic aspects (Oosthuizen, 2016). Technologies such as AI and IoT are widely spreading to the extent of affecting social life with examples of things like smart cities and self-driven cars (Mohanty, 2016). All these advancements in technology are collectively referred to as the fourth industrial revolution, which is a revolution that comes after the early three industrial revolutions (Maude, 2017). According to Clark, 2007 The first industrial revolution was seen in the 18th century with the advent of steam power and the invention of the power loom. This revolution focused on mechanization and radically changed how goods were manufactured (Deloitte, 2018).

Thereafter come the second industrial revolution, this was seen in the 19th century. It was marked by electricity and assembly line which made mass production possible. On the other hand, the third industrial revolution was marked by introduction to computers which enabled programming of machines and networks (Davis, 2015). In this era digitization and the internet was introduced. This revolution paved way for the 4IR which is characterized by the fusion between digital, physical and biological features impacting all disciplines (Gasper and Juliao, 2019). Further, according to PwC (2019) the 4IR is the unfolding age of digitization- from digitally connected products and services we consume, to advancements in smart cities and factories and increasingly common automation of tasks and services in our homes and at work (Ersoz et.al, 2018). This era of digital transformation ushers in new, real – time data gathering analysis and algorithmic decision and prediction making capabilities, thus creating a digital twin of our physical world. Similarly, according to Mukwawaya et al (2018), the 4IR is used to describe the evolution of automated and computer-controlled manufacturing facility into a more advanced facility that gathers and analyses data to make intelligent decisions autonomously.

In addition to the autonomous nature of the fourth industrial revolution, according to Schwab (2016) the 4IR is characterized by the blending of physical, digital and biological spheres. It is a revolution that comes with a lot of changes in the way factories, businesses, products, customers and society at large perform their operations and lives (Gasper and Juliao, 2019). Besides that, according to the study conducted by Mukwawaya et al (2018), the industrial work place will change in at least ten ways which have varying degrees of impact on the workplace and the extent to which new skills will be necessary to handle new task. New skills, tasks and future jobs will be a result of the various technologies that come in the package of the fourth Industrial revolution. These technologies have been mentioned and described by various industrial evolutions authors. For example, according to Cunningham, 2018 technologies promoted under the 4IR include AI, IoT, Virtual and augmented realities, additive manufacturing and blockchain.

Others according to Maude (2017) are distributed ledger technology, advanced materials and nanomaterials, energy capture, storage and transmission, new computing technologies, biotechnologies, geoengineering, neuro technology and space technologies. In addition, according to Ersoz etal (2018), technologies under the 4IR include cloud computing, data analytics and big data. These technologies are seen to present both benefits and challenges. Some of the challenges accompanying these technologies include invading of privacy, job and data security (Pwc, 2017). Parallel to these challenges, it is evident that benefits outweigh challenges as these technologies collectively bring massive advantages to individuals and organizations (PwC, 2019). The advantages are such as time saving, improved productivity, personalized experience, increased production, efficiency, and quality in production processes. It also increases safety at work by reducing jobs in dangerous environments. With availability of data it increases decision making abilities which includes developing products that best suit customer needs. The benefits are for both government and private entities (Gasper and Juliao, 2019).

Figure 1: The Fourth Industrial Revolution (ICTWorks, 2019)
Many countries in the world including Tanzania, are yet to experience the full benefits of the 4IR (Delloite, 2019). At individual level many are enjoying the benefits directly or indirectly through the use of personal items such as smart watches, 3D printings and Smart TVs while indirectly they enjoy benefits through water billing systems or online transactions that already use AI and IoT in simplifying their processes (Davic, 2015). For many organisations and business entities the use of the 4IR technologies is still low or not at all as there is a possibility that the level of awareness of the benefits is low or they are aware but are not ready for the change.

Fourth Industrial revolution in Tanzania

Tanzania just like other parts of the world is moving towards the fourth Industrial revolution. This revolution is preceded by the third industrial revolution that started back in the 50s (PwC, 2019). In Tanzania the third Industrial revolution started with the installation of the first computer back in 1965 (Esselaar & Adam 2013). Thereafter, the government and the society at large realised the benefits to be grasped from the use of that technology and a lot was done to make sure the country enjoys the revolution (URT, 2010). Some of the measures taken to facilitate the third industrial revolution was developing the ICT Infrastructure, developing the national ICT policy and offering ICT trainings (URT, 2003). Currently access to computers and smart phones is not an issue to the majority of Tanzanians. The internet, one of the revolutions in the third industrial revolution is also available to a great percent of the country (TCRA, 2020). The government made an effort to support this through putting in place the National ICT Broadband back bone and establishing the National Internet Data centre that has made hosting easy and cheap (URT, 2020).

All that was done during the third industrial revolution paved way for the fourth industrial revolution. So far little is seen of the revolution in Tanzania as majority of the professional in government and private institutions are not fully aware of these technologies to approve their full utilisation. For example, back in 2019 the Bank of Tanzania issued a public statement to discourage trading, marketing and use of virtual currencies (cryptocurrencies) to the general public. This was done because the national bank has not yet approved the use of virtual currency as an acceptable and used legal tender (BOT, 2019). This is similar to many African Countries such as Kenya, Ethiopia Nigeria, Cameroon and Ghana. Other African countries such as Namibia, Zambia, Zimbabwe and Swaziland have completely burned cryptocurrency and few like South Africa, Tunisia, Senegal and Seri Leon are on board with cryptocurrency and the blockchain technology (Arcane Research, 2020).

On the other hand, other technologies such as IoT and AI are well adopted specially at the individual level as many people are enjoying the use of smart watches, Smart Tv and other automated home appliances (Mohanty,2016). Many start-ups are also trying to bring solutions using the 4IR technologies in areas such as agriculture, health and education (Sahara ventures, 2019 b). Few start-ups available are Agrobot that provides accurate agricultural information using AI and JAMV1 a blockchain based platform that promotes access to capital for grass root farmers. Others are JEMBE that supports precise farming using drone’s technology and data science, Dr. Elsa another AI powered medical assistant while e-Shangazi is a knowledge sharing AI powered platform (Sahara, 2019 c).

As seen, most of the applications of the fourth Industrial revelation in Tanzania are either for individual cases or private start-ups. According to (WEF, 2017) in order for African countries to have economic shift they need to embrace the 4th Industrial revolution. In order to be ready for that, they need to overhaul their education system to prepare for these technological changes. The 4th industrial revolution heavily influence which skills are needed in the labour market around the world. Demand for software engineers, marketing specialists, writers and financial advisers is on the rise while demand for mechanical technicians, administrative assistants and accountants is on the fall. Furthermore, according to Cunningham, 2018 in order for governments to be ready for technological changes improvement efforts need to be focused on building awareness, establishing a financial plan, creating a robust legal framework, expand connectivity and data security, promote research and development and setting up new talent and education programs (Ersoz etal, 2018.).

Furthermore, according to Manda and Dhaou (2019) on their paper responding to the challenges and opportunities in the 4th industrial revolution for developing countries, several items are seen to be the drivers of the 4th industrial revolution. These items include Information and communication Infrastructure and emerging technologies, education and training, Innovation, policy innovation and responsive and context –specific strategies. Based on these studies, this study identified issues relevant towards the 4th Industrial revolution readiness in Tanzania.

Theoretical Background

Various theories on economic development and Industrial revolution have been written. These theories have been used by numerous scholars in explaining changes that include social, economic and other changes around democracy. However, this study focused on professional’s opinion on the fourth industrial revolution. In understanding the industrial revolutions, the modernization theory was used.

Modernization theory

Various theories have been developed to explain several aspects including development and community transformations. Modernization theory according to Lipset (1959) is one of these theories that tries to explain the relationship between society development and democracy. This theory identified social variables that contribute to social progress and hence social evolution. Modernization theory concentrates not only on the process of change but also on the response to change. It also looks at internal dynamics while referring to social and cultural structures and the adaptation to new technologies. The theory suggests that traditional societies will develop as they adopt more modern practices. Further according to Lipsets study, first step to modernization is urbanization followed by media growth, literacy and industrial development. These industrial developments bring about new technologies that later become major sources of social change. Technology makes it possible for a more innovative society and broad social change. The changes that have taken place
through centuries has evolved socially, industrially and economically bringing about the different industrial revolutions.

Figure 2: Modernization Theory (Lipset, 1959)

III. RESEARCH METHODOLOGY

In this study, Descriptive Research Design was used. This allowed the description of trends in the population as they exist, showing what is happening. This is as stated by Tromp and Kombo (2011) when emphasizing that descriptive design can be used when collecting information about people’s attitudes, opinions, habits or any of the variety of education or social issues. The questionnaire distribution was in electronic form which allowed the respondents to make sure every member of the population had an equal chance of being selected to be part of the sample (Kothari, 2004). Both qualitative and quantitative data were collected. Collected data was grouped and presented using frequency distribution statistical techniques. This enabled a thorough analysis of the data and hence provided visibility of what is available.

IV. FINDINGS AND DISCUSSION

Demographic characteristics of the respondents

Respondents of this study where 170 Tanzanian professionals who responded to an online questioner that was made available to the public through social media platforms mainly WhatsApp, face book and Instagram. Majority of these respondents, that is 65.9% were male and the remaining 34.1% were female. Respondents’ age ranged from 18 to 60 years of which the majority that is 47.3% were within 29 and 39 years, 33.7% were within 18 and 28 years while 16.6% were within the age range of 40 and 50 and lastly 2.4% were in the age range of 51 to 60 years. The respondents were also professionals from 25 different professions as see on table 1 below. A great percent of the respondents that is 21.2% was from the Information Technology (IT) and Computer science profession which brought together Computer Scientists, ICTOs, Cyber analysts, Information managers, IT specialists, Software developers, System Analysts, Web developers, MIS specialists and Network administrators. Apart from the IT and computing profession, 13.2% of the respondents were from the accounting profession. This included general accountants, those in accounting and financial management, auditors, CPAs and ACPAs. In addition, the study had a respondent who is an accountant and a videographer.

Table 1: Respondents Professions

<table>
<thead>
<tr>
<th>Sno</th>
<th>Profession</th>
<th>%</th>
<th>Sno</th>
<th>Profession</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IT and Computer Science</td>
<td>21.2</td>
<td>14</td>
<td>Procurement</td>
<td>1.3</td>
</tr>
<tr>
<td>2</td>
<td>Accountants</td>
<td>13.2</td>
<td>15</td>
<td>Cosmetologists</td>
<td>1.3</td>
</tr>
<tr>
<td>3</td>
<td>Student</td>
<td>11.3</td>
<td>16</td>
<td>Nutritionist</td>
<td>0.7</td>
</tr>
<tr>
<td>4</td>
<td>Lecturer</td>
<td>9.9</td>
<td>17</td>
<td>Pharmacist</td>
<td>0.7</td>
</tr>
<tr>
<td>5</td>
<td>Business</td>
<td>7.9</td>
<td>18</td>
<td>Photographer</td>
<td>0.7</td>
</tr>
<tr>
<td>6</td>
<td>Engineering</td>
<td>7.3</td>
<td>19</td>
<td>Writer</td>
<td>0.7</td>
</tr>
<tr>
<td>7</td>
<td>Education</td>
<td>6.0</td>
<td>20</td>
<td>Food production</td>
<td>0.7</td>
</tr>
<tr>
<td>8</td>
<td>Lawyer</td>
<td>4.0</td>
<td>21</td>
<td>HR Manager</td>
<td>0.7</td>
</tr>
<tr>
<td>9</td>
<td>Economics</td>
<td>4.0</td>
<td>22</td>
<td>I.T technician and accountant</td>
<td>0.7</td>
</tr>
<tr>
<td>10</td>
<td>Management</td>
<td>2.0</td>
<td>23</td>
<td>Intellectual property management expert</td>
<td>0.7</td>
</tr>
<tr>
<td>11</td>
<td>Banking and finance</td>
<td>2.0</td>
<td>24</td>
<td>Journalist</td>
<td>0.7</td>
</tr>
<tr>
<td>12</td>
<td>Technician</td>
<td>1.3</td>
<td>25</td>
<td>Community development</td>
<td>0.7</td>
</tr>
<tr>
<td>13</td>
<td>Librarian</td>
<td>0.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: research data

Furthermore, 21.2% of the respondents were lecturers and students who did not specify what professional areas they lecture and for students what their professional area of study was. Apart from that, the study also had 7.3% of engineering profession respondents, it was composed of engineers in Automobile, Broadcasting, Computer, Mechanical and Telecommunications.

These professionals had different levels of education. A larger percent that is 49.4% hold bachelor degree, 28% hold master’s degree, 7.7% certificate holders, 6% diploma holders, 6% PhD holders and 2.9 other levels.

Composition of the respondents was a true representation of professionals in Tanzania, distribution of the age ranges and the 25 professions was substantial to the results of the study.

Professional’s awareness of the 4th Industrial Revolution

Based on the response from the respondents a larger percent that is 97.6% are aware of the fourth Industrial revolution. On the other hand, only 2.4% of the respondents were not aware. Respondents aware of the revolution were asked to indicate the technologies they are aware of in this industrial revolution and the response was as follows;

Table 2: Fourth Industrial Revolution Technologies Aware to Professionals

[Table with columns and rows for the fourth industrial revolution technologies aware to professionals]
As seen on the table above, most respondents are aware of Internet of Things (IoT) technology followed by artificial intelligence (AI), data analytics, big data, block chain and bio technologies. These technologies that most respondents are aware of are applied in solutions that are closer to individual uses than in organisations. The application of IoT and AI has been common in things like smart watches, smart TVs and other items that are used in homes. Apart from this, most of the authors including Shawn (2018) in his report titled World economic forum and the 4IR in south Africa mention the above technologies as the most common technologies of the fourth industrial revolution. These technologies are also similar to those used by respondents in the study conducted by PwC, 2019.

Furthermore, out of the respondents 95.9% strongly agreed and agreed that the 4IR technologies will simplify processing and increase production while the remaining 4.1% remained neutral on the same. In addition to that, 75% of the respondents strongly agreed and agreed that the fourth industrial revelation has more advantages than disadvantages to their professions, 22.6% remained neutral while only 2.4% disagreed. This is similar to the general understanding of the 4IR as according to Manda and Dhaou (2019) the 4IR presents more opportunities than challenges. Further to this, according to Deloitte (2018) the revolution has the ability to change economies for example in banking the revolution allow banks to serve previously underserved communities. This means these technologies are meant to simplify existing processes aiming at increasing production and quality of the products.

On the other hand, 75.6% of the respondents strongly agreed and agreed that technologies in the 4IR will affect the way they perform their job. While 9.5 remained neutral and the remaining 14.9 disagreed and strongly disagreed that the technologies will affect the way they perform their jobs. The effect on how professionals perform their jobs is due to the overall nature of the 4IR technologies which integrates the fusion between digital, physical and biological features (Schwab, 2016). This has enabled variables that traditionally where not seen to be important in professional activities be included. These variables are such as consumer behaviours in respect to sells and integrations of human behaviour in technologies such as AI (Sahara Sparks, 2019).

### Table 3: Effect of Fourth Industrial Revolution Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>Strongly Agreed (Perc)</th>
<th>Agreed (Perc)</th>
<th>Neutral (Perc)</th>
<th>Disagreed (Perc)</th>
<th>Strongly Disagreed (Perc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th Industrial Revolution technologies simplify processing and increase production</td>
<td>55.9</td>
<td>40</td>
<td>4.1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4th Industrial Revolution technologies affect the way professionals perform their job</td>
<td>42.3</td>
<td>33.3</td>
<td>9.5</td>
<td>11.3</td>
<td>3.6</td>
</tr>
<tr>
<td>4th Industrial Revolution technologies have more advantages than disadvantages</td>
<td>33.9</td>
<td>41.1</td>
<td>22.6</td>
<td>2.4</td>
<td>0</td>
</tr>
</tbody>
</table>

### Fourth Industrial revolution readiness in Tanzania

Based on the respondent’s response, 55.1% of the respondents strongly agreed and agreed that Tanzania is ready for the 4IR while 15.4% disagreed and strongly disagreed of the same and the remaining 29.6% remained neutral.

![Figure 3: Respondents Opinion on 4th Industrial Revolution Readiness in Tanzania (source research data)](http://dx.doi.org/10.29322/IJSRP.10.11.2020.p107100)

Putting together the professionals who remained neutral and those who disagreed and strongly disagreed on Tanzania being ready for the fourth industrial revolution, the study found that a significant number of respondents that is 44.9% are not sure or do not thing
that the country is ready for the revolution. This is an alarming state although based on the percentage majority of the respondents agree that the country is ready. This is similar to the findings of the study conducted by Kopp and Basl (2017) that looked at readiness of Czech companies to the Industry 4.0. Findings of this study showed that some Industrial companies are already involved with Industry 4.0 technologies while others are not. Those that do not use these technologies showed that in order to go for fourth industrial technologies considerable investments need to be done. Furthermore, the study reveals that these investments should be supported by governments. In addition, the study indicated that those who were not ready for the revolution did not know much about it hence are not aware of the benefits that come along (PwC, 2017a).

**Issues relevant towards the 4th Industrial revolution readiness in Tanzania.**

**SKILLS**

According to various literatures and experiences from other countries, a countries readiness of the 4IR is measured by having the right skills that can manage the revolution technologies. In assessing Tanzania’s readiness, respondents were asked their opinion on available skills in relation to the fourth industrial revolution. Out of the respondents 67.6% strongly agreed and agreed that the skills they possess and sufficient for the use of the 4IR technologies, while 13.5% disagreed and strongly disagreed on the same and the remaining 18.8% remained neutral.

Apart from the majority acknowledging that their skills are sufficient, 91.2% of the respondents strongly agreed and agreed that an addition of new skills is required to be able to enjoy full benefits of the 4IR technologies. Remaining 8.8% was distributed between those that are neutral which is 7.1% and those who strongly disagree and disagree on the same occupying 1.7%.

Furthermore, respondents were asked whether Tanzanian education system provides skills required for the use of technologies in the fourth industrial revolution. On this question majority of the respondents that is 42.4% strongly disagreed and disagreed that Tanzania’s education system provides skills required for these technologies. Moreover, 29.4% of the respondents remained neutral and the remaining 28.2% agreed and strongly agreed.

The findings above demonstrates the confidence respondents have in the skills they possess. Majority of them agree that their skills are sufficient for the use of the 4IR although they also agreed to the need of required additional new skills. This is similar to the findings in the study conducted by Mukwawaya etal (2018) that revealed the need of new skills when looking into the readiness of South Africa for Industry 4.0. In addition, majority of the respondents remained neutral or disagreed on the chances that Tanzanian education system provided skills required for the use of 4IR technologies. This is similar to the recommendations in the study conducted by Deloitte (2018) which emphasised on the shift in education systems as a requirement for countries to be ready for the fourth industrial revolution.

**Infrastructure**

Professional gave their opinion on the available technology infrastructure assessing whether it supports the 4IR technologies. Firstly, professionals were asked if the technical infrastructure at their work place supports the fourth industrial revelation and the response was as follows. Out of the respondents 39.7% strongly agreed and agreed, 26.5% strongly disagreed and disagreed while the remaining 33.7% remained neutral.

Furthermore, since the internet is an important component in this revolution, respondents were asked if internet availability was sufficient for the fourth industrial revolution. From the response 53.2% strongly agreed and agreed that available internet was sufficient while 18.3% remained neutral and the remaining 28.4% disagreed and strongly disagreed.

Apart from their opinion on the current situation, majority of the respondents that is 93.5% suggested that technology infrastructure need to be improved to be able to fully enjoy benefits of the 4IR technologies.

Table 5: Respondents Opinion on Technological Infrastructure

<table>
<thead>
<tr>
<th></th>
<th>SA Perc</th>
<th>A Perc</th>
<th>N Perc</th>
<th>D Perc</th>
<th>SD Perc</th>
</tr>
</thead>
<tbody>
<tr>
<td>The technical infrastructure at your work place is supportive of the 4IR technologies</td>
<td>9</td>
<td>30.7</td>
<td>33.7</td>
<td>22.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Availability of the internet is sufficient for the 4IR technologies</td>
<td>20.1</td>
<td>33.1</td>
<td>18.3</td>
<td>22.5</td>
<td>5.9</td>
</tr>
<tr>
<td>To be able to use 4IR technologies, technical infrastructure needs to be improved</td>
<td>57.4</td>
<td>36.1</td>
<td>4.7</td>
<td>1.8</td>
<td>0</td>
</tr>
</tbody>
</table>

In the third industrial revolution, the government of Tanzania made significant efforts to improve technical infrastructure and access to the internet (Chogo, 2020). These improvements have paved way for the 4IR although based on the findings above majority of the respondents see that their work place infrastructure is not supportive of the 4IR technologies. On the other hand, improvements in internet access seems to be in favour of the 4IR.
technologies as majority agree and strongly agree that the internet is sufficient for the revolution. The feeling is not mutual for a significant number of the respondents that is 46.8% who remain neutral and disagree on the same. Although this is not the majority but their response sends a signal that all is not well. For this case, according to Morsy, (2020) for African countries to be able to enjoy the full benefits of the fourth industrial revolution, significant improvements need to be made to the technical infrastructure.

Policies and regulations

Professionals were also asked for their opinion on favourableness of available policies and regulations towards the fourth industrial revolution. These policies and regulations are both at organisation and country level. The response was as follows; majority of the respondents that is 91.1% advised that before the shift to the 4IR technologies research and development need to be done before implementation of the 4IR technologies. According to Waunde, (2017), for successful use of the 4IR in entrepreneurship and education in Africa research needs to be conducted so as to establish best models that work. This is similar to the findings of this study that emphasized on the importance of research and development.

V. CONCLUSION

The study focused on assessing Professional’s Opinion on the Fourth Industrial Revolution Readiness in Tanzania. It focused on evaluating Tanzanian professionals’ awareness of the 4IR and later looked into relevant issues towards 4th Industrial revolution readiness in Tanzania. Findings of the study indicated that professionals are aware of the 4IR and to their opinion Tanzania is ready for it. It also revealed that the most known technology in the 4IR is Internet of Things. Furthermore, the study revealed that the 4IR technologies simplify processes and increase production hence it has more advantages than disadvantages. On the other hand, professional’s opinion on skills indicated that professionals have sufficient skills in their professional areas but new skills are required so as to enjoy the full benefits of the industrial revolution. They also think that Tanzania’s education system does not provide sufficient skills to move with the revolution. The technical infrastructure is also seen to be supportive of the revolution but not at the best. Internet connection is available but not reliable while on the side of policies and regulations, professionals where not sure if they are supportive of the fourth industrial revolution. Lastly professionals thought that research and development need to be increased.

VI. RECOMMENDATIONS

Based on the findings and conclusion presented, the study is recommending the following:

More needs to be done to create more awareness and understanding of the revolution and its technologies to ensure full enjoyment of the benefits. Professionals need to be equipped with new skills required for the use of the 4IR technologies and also Tanzania’s education system needs to be adjusted to move with the technology revolutions. Technical infrastructure needs to be improved and a thorough review of policies and regulations need to be done. Finally, organizations and the country at large need to invest in research and development so as to find the best model to adopting the 4IR and its technologies.

Table 6: Respondents Opinion on Policies, Regulations, Research and Development

<table>
<thead>
<tr>
<th></th>
<th>SA Perc</th>
<th>A Perc</th>
<th>N Perc</th>
<th>D Perc</th>
<th>SD Perc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available policies and regulations are in favour of the 4IR technologies</td>
<td>7.1</td>
<td>26</td>
<td>34.3</td>
<td>29.6</td>
<td>3</td>
</tr>
<tr>
<td>A thorough review of policies and regulations need to be done before implementation of the 4IR technologies</td>
<td>39.1</td>
<td>47.3</td>
<td>11.2</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Before the shift to the use of the 4IR technologies research and development needs to be strengthened</td>
<td>50.9</td>
<td>40.2</td>
<td>7.1</td>
<td>1.8</td>
<td>0</td>
</tr>
</tbody>
</table>

REFERENCES


Analyse The Contribution Of Assets Management Strategies On The Customer Satisfaction Of Commercial Banks In Rwanda

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Abstract- The study was about Asset management strategies and customers satisfaction of commercial banks in Rwanda as the case study. The study was motivated by the various episodes of private bank failures in many parts of the world. This study therefore, examined the contribution analysis of Asset management strategies on customers satisfaction of commercial banks in Rwanda. To achieve, the general objective was to analysis the contribution of Asset management strategies on customers satisfaction of commercial Banks in Rwanda. A multimethod approach composed of both qualitative and quantitative research design was used. Data was collected from both primary and secondary sources using questionnaire and documentation were used. A population comprised of 270 from different commercial banks operating in Rwanda. Data was captured using the statistical package for sciences (SPSS 21) and presented into frequency tables. A simple regression and Anova analysis were carried out. A significance test t≤5% was assumed. The findings indicated that Asset performance measures have strong effect where the econometrics and statistical analysis shows a strong contribution with (β=0.721) on Satisfaction Rate (SR), (β=0.768) on the Customer Effort Score (CES); The same findings demonstrate that the Risk management strategies plays a positive contribution on customer satisfaction of Commercial banks where the econometrics and statistical analysis shows positive contribution of Asset management strategies with (β= 0.623) on Satisfaction Rate (SR) and (β=0.655) on the Customer Effort Score (CES). Lastly the findings demonstrate that the Asset portfolio Risk has a good effect on customers satisfaction of commercial banks in Rwanda where the econometrics and statistical analysis shows the ties contribution of Asset portfolio Risk with (β=0.531) on Satisfaction Rate (SR), (β=0.510) on the Customer Effort Score (CES) on customers satisfaction of commercial banks.

Index Terms- Asset portfolio Risk ; Risk management strategies and Asset performance measures

I. Historical Background

Introduction

Scholars and practitioners have been analyze the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks for some years, The Assets Management Strategies such as Asset portfolio Risk ; Risk management strategies and Asset performance measures in large Financial corporations has been documented to be a key ingredient in the revitalization of commercial Banks as well as in the ongoing management of these larger commercial banks. While the research on commercial banks is clear evidence that Assets Management Strategies plays an important contribution in the success of these commercial banks, there is less data to support the idea that Assets Management Strategies plays a similarly vital role in other levels of the executive chain, including the management efficiency, policy instrument and financial sector strategies segment, the dearth of research in the working capital component such as Cash, Raw materials and inventory, finished goods and Account receivable that surprising to consider the important contributions.

1.1 Contextual Expansion aspect

According to (WEF, 2014) the Steeped in a rich history of managing nation wealth, some big Banks in the world such as Clarien Bank established itself as one of Bermuda’s first family offices in 1974 demonstrate how to controlling corporate’s Assets Management Strategies. With deep roots in the community and a full suite of wealth management offerings, contries such USA, Western Europe and some Asian and African States were improved their wealth of a discerning, international clients based on whose changing and complex needs demand better tailored solutions.

Since the financial crisis period, clients have become increasingly engaged in the process of managing their wealth supported by the Assets Management Strategies. There is now a notable trend away from the dominance of global, wholesale banks, as families gravitate towards boutique-style wealth managers offering more personalised, bespoke financial solutions ; The contemporary client often has a global footprint and, as such, is increasingly seeking out a trusted advisor to help them navigate a more complex world, (Thomas, Franz, James, & Jess, 2011)

Today With increased reporting and due diligence standards, along with myriad tax regimes through which clients may operate, it is essential Assets Management Strategies providers solve these complexities and offer trust, estate planning and fiduciary services ; Furthermore, with a heightened awareness of one’s tax
obligations, it is important Assets Management Strategies have access to a network of multijurisdictional tax advisors and other service providers for their clients in order to assist in the setup of complex, tax-effective private client structures. (Ling & F. W. Kellermanns, 2010)

At the Continent perspective, After showing that the intensity with which people were enslaved and exported from Africa during the 1400–1900 period helps account for overall financial development, household access to credit, and firm access to finance which assisted them to improved their Assets Management Strategies, evaluate in three potential mechanisms linking the slave trade to modern finance information sharing institutions, trust in financial institutions, and the quality of legal institutions, (Ross, Chen, & Wensi, 2017)

According to (Lamar & Jason, 2017) Since the beginning of the 21st century, Africa has benefited from an unprecedented growth in GDP supported by the corporate’s Assets Management Strategies ; In fact, since the beginning of its ascent in 2002, it has risen to become one of the fastest growing regions in the world ; Despite suffering a serious economic downturn during the global financial crisis, overall African nominal GDP growth has managed to stay at around 12.4 percent on average supported by increasing the Assets Management Strategies

At the regional perspective, the origins of the Assets Management Strategies in East African Community (EAC) can be traced back to the long history of Finance, trade, administrative, and socio-cultural ties between Partner States, stretching back nearly a century in its present form was formally created to include Kenya, Tanzania, and Uganda in 1999, In 2007, EAC membership was extended to Burundi and Rwanda, (Elke & Craig, 2017)

According to (Sandrey, 2015), The EAC implemented a Customs Union from the beginning of 2005 as a significant milestone achieved with the signing of the Common Market Protocol in November 2009, ratified by all Partner States in April 2010; The agreement envisages the phased liberalisation of Assets Management Strategies in financial services and the elimination of restrictions on the free movement of capital by 2015 at the latest supported by strong Assets Management Strategies on the achievement of Customer satisfaction component such as cash, accounts receivable (customers’ unpaid bills) and inventories of raw materials and finished goods, current liabilities and accounts payable.

For (World Bank., 2014) About 22 multinational and transnational finance corporate such as Kenya Commercial Bank, Equity Bank, Fina Bank, and Commercial Bank of Africa and others owned by EAC members states as hub are operating in the region; There are four (4) Kenyan banks with a total of 63 branches 35 in Kenya,16 in Tanzania, 31 in Uganda 16 in Rwanda, 7 in Burundi in 2012.

At National perspective, the development of the Assets Management Strategies in Financial sector in Rwanda was based on few financial institutions composed by 3 commercial banks and 2 specialized banks operated with a total of less than 20 branches in the country, and one microfinance (UBPR) with around 146 branches which the genocide affected heavily the banking sector as resulted in closure of the Central bank for 4 months, government wealth looted, with two-thirds of the national monetary base in addition to US $7 million in cash which was taken from the UBPR as consequently, contry took almost a period to reestablish Rwandan financial system, (Ingabe & Kigabo, 2016)

According to the same scholar (Ingabe & Kigabo, 2016) The post genocide period was marked by increase in number of banks, where in 2010 there were 6 commercial banks with 28 branches, 2 specialized banks and 1 union of financial institutions (UBPR) with 148 branches, only 7 % of all branches of financial institutions and by the end of 2019, 10 commercial banks, 7 specialized banks and 34 Microfinance bank were in operations supported by Assets Management Strategies in the Country.

I.1 Problem Statement

Since 2011, Rwanda coordinated its the Financial sector improving for its Assets Management Strategies plans such as Asset portfolio Risk; Risk management strategies and Asset performance measures which assisted on her customers satisfaction in the Commercial Banks with the implementation of the country where its aiming to become a Middle Income Country (MIC) status by 2035 and High-Income Country (HIC) status by 2050. This has made the Country to be ranked by several international bodies such as International Monetary Fund, World Bank; World Economic Forum on Africa; Easy of Doing Business, (Laure, et al., 2020)

Some studies including (BNR, 2019) (Karemmera, 2013) and (BK, 2014) indicate the highest level of despite the widely recognized importance of the Financial Sector and the increased the international attention in this area, at which Assets Management Strategies operations remains low at domestic level as facing a low level of contribution on her dependent indicators of Satisfaction Rate (SR) and Customer Effort Score (CES), to face the Financial challenges in which should resolve by them.

Based on the above studies, different challenges entitled gaps such as feeble investment in Financial sectors of 17%, the low level of using management systems and management capacities services at the rate 9%, low Skills and expertise of implementing financial leadership at the rate of 21% low savings rate level of 16.6%, High-interest rate of 20%, and total assets decreased from 58% in 2010 to 42% in 2015, the population living below the poverty line to less than 30%; extreme poverty to less than 9%, Unemployment Rate of 13.2% and this could be fixed by the Assets Management Strategies management and control., however, it has no enough effect on customers satisfaction of Commercial Banks in Rwanda.

This is the reason the Researcher decided to carry out a study, which provided his contribution to the aforementioned gaps by analyse the existence contribution of Assets Management Strategies and customers satisfaction of Commercial Banks in Rwanda.

I.2 Research Objectives

The general objective is to analyze the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks

I.2.2. Specific objectives

- To Analyze the contribution of Asset Portfolio Risk on the Customer Satisfaction of Commercial Banks
- To assess the impact of Risk management strategies on the Customer Satisfaction of Commercial Banks
I.3 Research hypothesis

According to (Creswell J., 2009) the Hypothesis is defined as a proposition which can be tested to determine its validity; it may prove to be correct or incorrect (positive or negative aspect). The function of hypothesis is to test specifically relationship between phenomena in such way. Referring on this assumption the researcher verified if really and at what extent the pillars of Independent variable in this study (Asset portfolio Risk; Risk management strategies and Asset performance measures) has a significant role on the dependent variable in this study (Customer Satisfaction of Commercial Banks). The Hypothesis of this study was proposed based on the Creswell’s confirmation hypothesis: The Asset Portfolio Risk has no significant contribution on the Customer Satisfaction of Commercial Banks

II. Diverse Literature on the contribution of Assets Management Strategies and Customer Satisfaction of Commercial Banks

Different theories and models from Literature were used that assisted the conceptual contribution between Assets Management Strategies and Customer Satisfaction of Commercial Banks, Rwanda as a case study.

II.1.1 A Modern Portfolio Theory Approach to Asset Management in the listed South African Property Market

According to (Albertino, 2009) A Modern Portfolio Theory Approach to Asset Management in the listed South African Property Market is generally less risky than the same asset held in isolation of Brigham and Gapenski; The expected rate of return on the portfolio is a weighted average of the expected returns on the components, with the same portfolio properties as weights. For example, in the simplified case of two securities, the portfolio return can be calculated as follows:

$$E(rp) = W A E(rA) + W B E(rB)$$

Where

- $E(rp)$ = Expected return of Portfolio P
- $E(rA)$ = Expected return of security A
- $E(rB)$ = Expected return of security B
- $WA$ = Proportion of portfolio invested in security A
- $WB$ = Proportion of portfolio invested in security B

Kinghorn suggested that if the same were true for portfolio risk, investors would have little, if any incentive to diversify their holdings. Any risk-spread benefits would be offset by a reduction in expected returns (Kinghorn, 1990). It is clear that under these conditions an investor would simply set their specific risk levels and choose the security or asset that offered the required returns. However, portfolio risk is a function of the weighted average of the individual variances plus the weighted covariance’s between the returns of pairs of shares. In the simplified case of two securities, with returns on the individual securities having a normal distribution, the portfolio standard deviation can be calculated as follows:

$$\sigma_p = \sqrt{(WA \sigma_B)^2 + (WB \sigma_B)^2 + 2 (WA \sigma_A)(WB \sigma_B) \rho_{AB}}$$

Where

- $\sigma_p$ = Portfolio variance (represents risk)
- $\sigma_A$ = Standard deviation of security A
- $\sigma_B$ = Standard deviation of security B
- $WA$ = Proportion of portfolio invested in security A
- $WB$ = Proportion of portfolio invested in security B
- $\rho_{AB}$ = Correlation coefficient between A and B

The variance of the portfolio is a sum of the contributions of the component security variances plus a term that involves the correlation coefficient between the returns on the component securities. The correlation coefficient between security A and B should between -1 and 1 for example -1< GAB <1. If the correlation between the component securities is small or negative, then there will be a greater tendency for the variability in the returns on the two assets to offset each other. This will reduce portfolio risk. The reduction in portfolio risk is represented by portfolio variance in the above equation, when the correlation coefficient is lower.

All property investment requires careful analysis of many contingencies on which the decision depends. There are five basic steps that will guide an investor to make an investment decision. The five steps are as follows.

(i) Identify the goals, objectives and constraints of the various participants in the investment process which an investment must satisfy in order to be acceptable.

(ii) Analyse the overall investment environment-market, legal, financing and tax in which the investment decision must be made.

(iii) Forecast the expected future benefits and costs (cash flows) arising from the ownership of the investment. This analysis involves four types of decisions: operating, financing, and reversion decisions as well as tax planning.

(iv) Apply appropriate decision-making criteria to compare the benefits with the costs of the investment. An analysis must be carefully developed to be relatively certain of the investments ability to meet the constraints and objectives of all the participants in the investment process.

(v) Accept or reject the investment under the assumptions of the input variables.

The investment process is used to discover whether a particular investment is feasible. A property investment is feasible when the investor determines that there is a reasonable likelihood of satisfying explicit investment objectives, which must be tested against a specific set of structure in which the expected risks and expected returns can be analysed.

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p107101
II.1.2 The Risk Management theory: the integrated perspective and its application in the public sector, (Ignacio, 2013)

According to (Ignacio, 2013), the Despite these possible theoretical disputes in the conception of risk mentioned before, we should focus in our case, in the different application of the concept in social science. In finance for instance, risky options involve monetary outcomes with explicit probabilities and they are evaluated in terms of their expected value and their riskiness. Thus the traditional approach to risk in finance literature is based on a mean-variance framework of portfolio theory of Markowitz; Moreover, the idea of risk in finance would be understood within the scope of systematic (non-diversifiable) risk and unsystematic (diversifiable) risk of Gehr; Another established concern in finance is default risk and it is often argued that the performance of the firm is linked to the firm’s default risk Shapiro and Titman. A large part of the literature on risk on finance, deals as well with several techniques to measure the risk of the firm’s investment portfolio.

the Risk in economics on the other hand, is understood within two separate categories, endogenous (controllable) risk and background (uncontrollable) risk. Thus, it is recognized by scholars that economic decisions are made under uncertainty in the presence of multiple risk.

Therefore, the researchers can say that economics, or to be more precise Neoclassic economy, argue that people would be risk averse when the size of the risks would be large; Therefore, in economics, the concept of risk-bearing preferences of agents for independent risk would be described under the notion of “standard risk aversion”. While the economist assumes an individual’s risk preferences as a function of probabilistic believes, psychology would explore how human judgment and behavior systematically forms such beliefs. As a consequence, psychology mainly concentrates in the risk taking behavior (risk preferences); Therefore this discipline searches for the patterns of human reactions to the context, reference point, mental categories and associations that influence how people make decisions.

The same scholar (Ignacio, 2013), risks might affect economic activity through the psychological influence of uncertainty. Risk perception plays a central role in psychology, where the key concern is how individual perceives risk and how it differs from the actual outcome.

Additionally the sociological perspective on risk was originated from the psychological and anthropological view of the discipline. Nonetheless, in the last decades we have seen some convergences between economist and psychology in the literature of economic behavior, a distinctive discipline of decision theory. The intention of this approach is to include the standard economic model of individual’s formal rational action in the understanding of the way they actually think and behave (irrationality). In contrast to efficient market hypothesis behavioral economics would provide descriptive models in making judgments under uncertainty. Consequently, the researchers might see several disciplinary overlaps considering the concept of risk which is currently progressing with the emerging of new research on the topic.

Finally and for the purpose of this article we will select a definition of risk, which should be coherent with the objectives and scope of the document. The definition of risk that researchers will use for this article as being more consistent with the modern perspective of Risk Management, is “the distribution of possible deviations from expected results and objectives due to events of uncertainty, which might be internal or external to the organization”. In this perspective, the influence of risk factors could have then connotations of positive or negative and assumes the risk to be a generator of both potential losses and opportunities. Both elements together ambivalence of threat and opportunity as well as the chance to create the desired future might explain why risk management has become so popular in business and politics.

II.1.3 A Performance Management Model For Physical Asset Management By (JL & DC, 2016)

According to (JL & DC, 2016), the Performance management is a topical subject in business and the past decade has seen a significant number of publications on performance related issues, such as performance frameworks, operational efficiency and performance integration. Performance can be seen as a collection of processes that will assist stakeholders in taking appropriate actions to create a performing organization in the future (i.e. more efficient and effective) Lebas and Euske. To take such actions, decisions must be based on information from quantitative indices. This process of measuring and collecting performance data, interpretation, identifying problems and making decisions to improve performance within the scope of the business goals, have been associated with the term performance management (Kaydos. Industry has become obsessed with performance, attempting to quantify every aspect of a business (Neely and Austin), whilst not focusing on the “critical few” processes that do need to be managed. Although companies have always managed their assets, Woodhouse asset management is becoming increasingly important. In today’s competitive business environment it is prerequisite to manage assets effectively and efficiently in order to get maximum return on investment. This can only be achieved by considering the entire life cycle of the asset together with all related costs.

A general description for asset management is the global management process through which the highest value decisions regarding the use and care of assets are made and executed. In conjunction with the asset life cycle, and acknowledged by authors (for example, Woodhouse, it is clear that asset management affects all areas of the business. Therefore it needs to be aligned and integrated into functional and operational business processes. The relationship between asset management and structured performance management was identified through systems thinking philosophies such as Total Productive Maintenance and reliability models. In the current business environment a mere relationship proves to be inadequate. Modern performance practices promote the vertical integration between top-level goals and operational strategies as well as horizontal integration between process results and customers’ requirements. These practices need to be applied to asset management explaining the need for synergy between asset- and performance management that can be incorporated within business processes.
II.1.4 Consumer Satisfaction Theories: A Critical Review by (Atila & Fisun, 2008)

According to (Atila & Fisun, 2008), this theory has not gained much support from researchers, partly because it is not clear whether consumers would engage in such discrepancy adjustments as the model predicts in every consumption situation. In his criticism of the Dissonance theory, Oliver for instance, argues that "Generally, it is agreed that satisfaction results from a comparison between X, one’s expectation, and Y, product performance. Thus, it is the magnitude and direction of this difference, which affects one’s post-decision affect level. X serves only to provide the comparative baseline. Moreover, consumers are under no particular pressure to resolve the X-Y difference. In fact, satisfaction/dissatisfaction is thought to arise from recognition and acknowledgement of dissonance" (p. 206). If the Dissonance Theory holds true, then companies should strive to raise expectations substantially above the product performance in order to obtain a higher product evaluation.

However, the validity of this assumption is questionable. Raising expectations substantially above the product performance and failing to meet these expectations may backfire, as small discrepancies may be largely discounted while large discrepancies may result in a very negative evaluation; This suggestion fails to take into account the concept of "tolerance level". The tolerance level suggests that purchasers are willing to accept a range of performance around a point estimate as long as the range could be reasonably expected. When perceptions of a brand performance, which are close to the norm (initial expectation), are within the latitude of acceptable performance, and then it may be assimilated toward the norm of Woodruff. That is, perceived performance within some interval around a performance norm is likely to be considered equivalent to the norm. However, when the distance from this norm is great enough, that is perceived performance is outside the acceptable zone, then brand performance will be perceived as different from the norm, which, in contrast to this model’s assumption, will cause dissatisfaction not a high product evaluation.

The Dissonance Theory fails as a complete explanation of consumer satisfaction, however, it contributes to the understanding of the fact that expectations are not static in that they may change during a consumption experience. For instance, the importance attached to pre-holiday expectations may change during the holiday and a new set of expectations may be formed as a result of experiences during the holiday. This implies that as customers progress from one encounter to the next, say from hotel's reception to the room or the restaurant, their expectations about the room may be modified due to the performance of the previous encounter.

II.2 The Econometric Model on the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks

The researchers empirical strategy was used to test the to analyze the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks, uses the methodology of (Beck et al. 2004) to analyze the empirical contribution between Assets Management Strategies on the Customer Satisfaction of Commercial Banks. Thus, the researchers regression equation of financial performance of commercial banks is defined as follows:

$$W_{it} - W_{it-1} = \alpha W_{it-1} + \beta INS_{it} + \delta X_{it} + \eta_t + \epsilon_{it}$$

(1)

where \((W_{it} - W_{it-1})\) is Customer Satisfaction of Commercial Banks, \(X\) represents a vector of control variables (Satisfaction rate, Net Promoter Score (NPS), Customer Satisfaction Score (CSAT), Customer Effort Score (CES) and Intention to buy again), The researcher use the following approximation to calculate the Satisfaction Rate (SR) and Customer Effort Score (CES) between \(t\) and \(t-1\):

$$\frac{W_{it} - W_{it-1}}{W_t} \approx \ln(W_{t-1} + \frac{W_{it} - W_{it-1}}{Y_t})$$

According to literature on Satisfaction Rate (SR) and Customer Effort Score (CES) regressions to Solow, authors such as Beck et al. (2002) and Allen et al (2001), made an assume of technical progress rate and a depreciation rate of the physical capital constants, the sum of which is \(\rho + d = 0.05\)

The government consumption, openness to commercial and terms of commercial, \(W_{it-1}\) the logarithm of initial Satisfaction Rate (SR) and Customer Effort Score (CES) to control the conditional convergence effect of the standard Solow-Swan growth theory and INS is customers satisfaction penetration defined as ratio of premiums to Satisfaction Rate (SR) and Customer Effort Score (CES). \(\eta_t\) is time fixed effects, \(\epsilon_{it}\) is the idiosyncratic error term and the subscripts \(i = 1, \ldots, N\), and \(t = 1, \ldots, T\) represent country and time period, respectively. In equation (1), \(\beta\) is the researcher coefficient of interest and allows to analyse the effect of Customer satisfaction in commercial Banks. The researcher anticipate a positive sign for \(\beta\).

Furthermore, the convergence hypothesis between the financial studied suggests that the coefficient \(\alpha\) of \(W_{it-1}\) is negative and significant in the growth model, ie 0 < 1 < 1. To examine the heterogeneity the effect analyse of Asset management strategies on Customer satisfaction in Commercial Bank, the researcher specify an augmented version of equation (1) as follows:

$$W_{it} - W_{it-1} = \alpha' W_{it-1} + \beta' INS_{it} + \rho' (INS_{it}) + \gamma' MS_{it} + \delta' X_{it} + \eta_t + \epsilon_{it}$$

Where \(MS_{it}\) represents the conditional variables of country-specific structural characteristics which are Asset portfolio Risk; Risk management strategies and Asset performance measures and Customer satisfaction in Commercial Bank composed by Satisfaction Rate (SR) and Customer Effort Score (CES); The three categories of conditional variables defined above include variables described as follows: first, to analyse whether Asset portfolio Risk has a positive contribution on Customers satisfaction in Commercial Bank in Rwanda; Second, to assess if Asset performance measures has a positive impact on Customer satisfaction in Commercial Bank in Rwanda; Lastly, to understand if management capacities have a positive effect on Customer satisfaction in Commercial Bank in Rwanda. The researcher retains the Asset portfolio Risk; Risk management strategies and Asset performance measures in Commercial Bank composed by Satisfaction Rate (SR) and Customer Effort Score (CES), by himself but also through complementarities with Financial Sector in general, Commercial banks in particular.

II.3 Conceptual framework
A Conceptual framework is a diagrammatical research tool intended to assist the researcher to develop awareness and understanding of the situation under scrutiny and to communicate this (Kandampully & Tingting, 2019). In this case the researcher find out that the Financial statement analysis is the process of reviewing key financial documents to gain a better understanding of how Customer satisfaction in Commercial Bank are performing in terms of impacting the Balance Sheet, Income Statement, Cash Flow Statement and the Annual Report.

Normally the Customer satisfaction in Commercial Bank in Rwanda are characterized by different indicators such as Satisfaction rate SR, Net Promoter Score (NPS), Customer Satisfaction Score (CSAT), Customer Effort Score (CES) and finally Intention to buy again which all of these component can have academic challenges to analyse all of them based on the limitations on one side academic linkages between these pillars of Asset management strategies and its indicators of are Asset portfolio Risk; Risk management strategies and Asset performance measures and on other side of dependent variable.

Based on that challenge, the researcher was focused on two active indicators only such as Satisfaction Rate (SR) and Customer Effort Score (CES)

A theoretical framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought. It can be defined as a set of broad ideas and principles taken from relevant fields of inquiry and used to structure a subsequent presentation. In this conceptual framework in figure 2.1, there are demonstrate the linkage between the independent variable and dependent variable is an outline

**Figure 2.1: Conceptual framework, 2020**

**Source:** (Dickson, Emad, & Joe, 2018), modified by the researcher 2020
In figure 2.1, the conceptual framework gives an overview of the types of research variables that play roles in this study. In the above conceptual framework are Asset Portfolio Risk; Risk management strategies and Asset performance measures are independent variables. The independent variables that are Asset management strategies also referred to as manipulating variables deal with all theories and practices related to customers’ satisfaction of commercial banks; On the other hand, bank performance is the dependent variable measured such as Satisfaction Rate (SR) and Customer Effort Score (CES).

The use of appropriate framework Asset portfolio Risk in commercial banks gives them competitive advantage, reduces costs in most operations and services, and leads to efficiency in transactions and better customer services; These in turn lead to better Bank performance of commercial banks which adopt framework Risk management strategies in their operations; On the other hand when commercial banks don’t adopt framework Asset performance measures, they are likely not to realise competitive advantage, their costs should be high in most operations and services, maybe inefficient in their transactions and they should offer poor customer serve which in turn lead poor Bank performance; accordingly when there are good and favourable...
Prudential regulations like Monetary Policy and Banking regulation, working capital of commercial banks should be high and low when regulations, policy instruments and sector strategies are poorly crafted and unfavourable.

After firms achieve optimal efficiency in Asset performance measures such as Leadership capacity building management and Research and Development utilization and deploying them to effectively two likely scenarios can emerge: The organizations will be very successful at home and amass sufficient resources and capabilities that they can effectively deploy in competing regionally and globally: As a result, these firms should expand regionally and globally and into new products either to stretch their success record globally or to protect their home advantage; In expanding regionally and globally and into new products, these firms gain access to complementary resources domiciled within these new territories leading to greater heterogeneity and complementarily enhancing regional and global competitiveness; This is an initial explanation of resources, expansion strategies, and performance. Conversely, after internal efficiency is attained firms may fail to deploy their internal competitiveness effectively within territorial markets.

II.4 Empirical analyses on the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks

   Different Knowledge and results derived from the investigation, observation, experimentation, and experiences were done by different researches on similar work with Assets Management Strategies with is pillars of Asset portfolio Risk (Personalized Portfolio Management Active Tax Management); Risk management strategies (Proactive design and Business process improvement) and Asset performance measures (Rate of Return Calculations

   Risk and Risk-Adjusted Measures of Performance) Customer Satisfaction of commercial Banks (Satisfaction Rate (SR) and Customer Effort Score (CES)) were dependent variables while Prudential regulations (Monetary Policy and Banking regulation) as intervening Valuable on opposed to the theoretical knowledge based on logical or mathematical assumptions to drive the study.

II.4.1 The contribution of Asset Portfolio Risk on the Customer Satisfaction of Commercial Banks

   According to (Florin, Drahomira, & Bruce, 2017) The contribution of Asset Portfolio Risk on the Customer Satisfaction of Commercial Banks may wish to split their funds between securities – for example in a two asset portfolio say 50% of A and 50% of B in which case the portfolio return will be a weighted average of the expected returns on the individual securities. If we return to our example and select Securities A & B for illustration purposes and invest 50% of our funds in A and 50% of our funds in B the expected return will be (5.2% x 0.5) + (3.6% x 0.5) generating a weighted return of 4.4% for this two security portfolio.

   For (Ray, 2010) The contribution of Asset Portfolio Risk on the Customer Satisfaction of Commercial Banks in big part of Europe, especially in the Czech Republic has been the engine for the inclusive growth of the country, both in terms of economic performance and in terms of labour market. With the annual production of 118 vehicles per 1,000 inhabitants, the automotive sector makes up nearly 25% of the country’s industrial production and exports and contributes approximately 7.4% of GDP (Kozelský & Novák, 2015). In 2016, cars were exported for the total amount of $18.7 billion and vehicle parts of $13.5 billion.

   As for (Khan, 2011) The contribution of Asset Portfolio Risk on the Customer Satisfaction of Commercial Banks with average return of the auto manufacturers (2005-2014) stands on the level of 16% while mean return is 15.9%; The average risk based on results of 2005-2014 captured from the formula (1), is 6.3%; Volatility of returns is computed on the winsorized values (2.5% smallest and largest values were replaced by respective 0.025 and 0.975 quantile values) to eliminate influence of outliers. The findings shows risk-return characteristics of manufacturers in Portfolio A on the yearly basis.

   For (William, 2018) The contribution of Asset Portfolio Risk on the Customer Satisfaction of Commercial Banks was also broken down into a number of categories including age of the firm, peer group, NSE listed, number of years in operation, number of clients, asset base and turnover. The analysis shows that 60.8% of the commercial banks in Kenya were 10-15 years old, 24.2% of the banks were 6-10 years old, 10% were 16-20 years old, 3.3% were over 20 years old while 1.7% of the banks were 0-5 years old. The majority of the banks (38.5%) had asset base of 10 billion and above. About 54.2% of the commercial banks in Kenya had 100,000-500,000 customers while 44.2% of the commercial banks in Kenya had a turnover of less than Kshs. 50 billion. About 57.5% of the firms belonged to tier I, 23.3% of the firms belonged to tier II while 19.2% of the firms belonged to tier III. Nearly 81.7% of the commercial banks in Kenya were not listed in NSE while 18.3% were listed in NSE. About 60.8% of the commercial banks had operated in Kenya for 11-15 years, 24.2%.

   “Risks are evaluated with assumptions and uncertainties being clearly considered and presented” had a mean of 4.4 and a standard deviation of 1.23. “Risk is evaluated in terms of both quantitative and qualitative value” had a mean of 4.7 and a standard deviation of 1.17.

   According to (Harelimana, 2017) analytically showed that the contribution of Asset Portfolio Risk on the Customer Satisfaction of Commercial Banks in Rwanda was increased the portfolio size of 20 is required to eliminate 95 % of the fiable risk on required to eliminate an extra 4 % (i.e., 99 % total) of fiable risk ; the result depends neither on the investment horizons, sampling periods nor the markets involved; But the number of stocks required in portfolio in order to eliminate the same percentage of fiable risk ; according to the size of population ; For example, in order to eliminate 98 % of fiable risk, 50 stocks are required in 10000 stocks population and 22 – in 40 stocks population.

   Same scholar (Harelimana, 2017) show the perception of the respondents about business risk in RSSB; respondents with a mean of 2.8500 and standard deviation of .94266 agree that RSSB manage financelal risk by investing in more than one asset, respondents with a mean of 2.9750 and standard deviation of .42022 agree that Financial risk is one of unsystematic risks which can be reduced through diversifiedlon, respondents with a mean of 2.5625 and standard deviation of .82437 appreciate the way RSSB manage its financelal risk, respondents with a mean of 2.5375 and standard deviation of .77857 agree that RSSB investments are nationwide, in most of all the districts in Rwanda most especially in the real estate sector, respondents with a mean

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of 3.0125 and standard deviation of .66549 agree that Financial Risk stems from the alteration in capital structure of the firm correlated with the company’s financing activities.

II.4.2 The impact of Risk management strategies on the Customer Satisfaction of Commercial Banks

According to For (Sundararajan & Balino, 2011) The impact of Risk management strategies on the Customer Satisfaction of Commercial Banks carry out risk evaluations while 37% of the respondents indicated that enterprises carry out risk evaluations; They also indicated that enterprises carry out risk evaluations to enable them to correctly understand, evaluate and manage the risk exposure embedded in its existing and future lines of business. This is in line with Speklé (et al., 2007), who stated that many firms have realized the importance of risk management in IT project management to achieve project success.

For (Esther, Kennedy, & David, 2015) The impact of Risk management strategies on the Customer Satisfaction of Commercial Banks gave almost 62% of its contribution indicated that enterprises undertook risk identification for the purposes of mitigating risk facing projects to a very great extent, 30% indicated to a great extent while 8% enterprise undertook risk identification for the purposes of mitigating risk facing projects to a moderate extent. This implied that the enterprises distinctive risk identification effort to influence achievement of project performance.

As for (EAC., 2011) the new membership of Burundi and Rwanda in the EAC Risk management strategies on the Customer Satisfaction of Commercial Banks process has come to further widen the market up to 135.5 million people in 2010; The expanded trade and investment among the EAC Partner States has increased economic growth and development prospects in the region, with regional GDP (at constant 2000 levels) increasing from US$42.4 billion in 2006 to 74.5 billion in 2009 and is expected to reach $80 billion in 2012. Uganda, Rwanda and Tanzania sustained incremental growth trends between 2006 and 2008.

For (Didier & Michael, 2014) the results on the impact of Risk management strategies on the Customer Satisfaction of Commercial Banks between risk transfer and performance of Kigali Gatuna road rehabilitation project was at 0.827 mean that risk transfer was at the level of 82.7% which proves significant relationship between risk transfer and project performance. If the researcher considers the level of significance which is 0.05, there is therefore a significant relationship between risk transfer and performance of Kigali-Gatuna rehabilitation project because their p-value (0.000) is statistically significant at 5%.

II.4.3 The effect of Asset performance measures and the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks

According to (Aditya, 2016) the Asset performance measures on analyze the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks demonstrates an ISO 55002 offers interpretation and guidance for such a system to be implemented in accordance with the requirements of ISO 55001. The adoption of ISO 55000 series is to enable an organization to achieve its objectives through the effective and efficient management of its assets. Implementation of this asset management system provides assurance that organizational objectives can be achieved consistently and sustainably over time. Besides, ISO 5001 for energy management was launched in 2011; ISO 27001 on information security was released in 2013. Presently work is going on to finalize ISO 45001 on occupational health and safety during 2016.

For same scholar (Elizaveta, Irina, & Yegor, 2020) The Asset performance measures on analyze the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks in different countries of Europe and northern American appeared to provide either a theoretical (45.2%) or descriptive (33.9%) contribution, while 20.7% of papers have a prescriptive orientation. Among the theoretical papers, conceptual or exploratory are presented by an even number (42% of each type), and only 16% of papers appeared to be predictive. Only two papers from the sample were found to have a normative orientation and were primarily devoted to sustainability issues. Most of the prescriptive papers (81%) are instrumental.

As for (Anna, Macleans, & Roseline, 2013) the Asset performance measures on analyze the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks IN EAC Tea tops with very high RCA of 961.3 well above the minimum of 1. It is followed by jute with RCA of 823.6. Cut flowers are in a third place with 653.3. Tanzania is the second competitive country in the EAU. It has revealed comparative advantage in 471 product lines. It is highly specialized in the production of such products. Tanzania has a very high RCA of 2263.5 in the production of raw furskin pieces. It is followed by ivory in which it has RCA of 1173.7. The third place is occupied by precious metal ores and concentrates with RCA of 1108.6. Tanzania like Kenya the top 10 products are predominately primary products.

As for (MBONIGABA, 2019) The Asset performance measures and the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks ECOBANK generated reported diluted earnings per share (EPS) of 0.28 U.S. Dollar cents, a fall of 83% compared with the 1.69 U.S. Dollar cents reported in 2014. Return on total shareholders’ equity (ROE) was 4.2% in 2015 versus 16.5% in the prior year. Profit attributable to shareholders of ETI amounted to $66 million, compared to $338 million in 2014.

The major reason behind these less than satisfactory results was the high level of impairments on loans and financial assets made in 2015, totaling $532 million, almost double 2014’s level. For instance, the reported revenues decreased by 8% in 2015, underlying revenues would have increased by 9%, assuming constant exchange rates. The cost base remained fairly stable, with a cost-to-income ratio (CIR) of 64.9%; The balance sheet is healthy, with a Tier 1 ratio of 20.5% and a total capital adequacy ratio (CAR) of 23.9%; The revenue for the year ended 31 December 2015 was $2.1 billion while that of the parent company was $174 million. Profit before tax for the Group was $205 million and $61 million for the parent company. The profit after tax stood at $107 million, (ibid,2019).

II.4.4 The importance of Customers satisfaction on commercial Banks in Rwanda

According to (Kabu & Soniya, 2017) The importance of Customers satisfaction on commercial Banks demonstrates the
service provider and service receiver is really important to make the relation smooth; The grey section of graph shows 37% of the members are in neutral with the amount of contact between Customers satisfaction and the members; While 30% of the total members thought that the communication between the organization and the customer was not satisfactory; Meanwhile, 27% of the respondents were satisfied with the contact between Customers satisfaction and the members. Although the percent is still less than other, 7% of the customers need to have an adequate amount of the contact and discuss the problems that they are facing.

For (Tao, 2014) All the members of the Trivsel are getting a response regarding their concerns and question about the services. 80% of the member’s states that Customers satisfaction has been very responsive to the questions and concerns about the services. Whereas, 13% of the respondents states that Customers satisfaction is extremely responsive. The figure also shows there are a certain percentage of customers who didn’t fully agree that, Customers satisfaction is responsive regarding to concern of the customers. According to the pie chart, it mentions that 3% out of total respondent believes that Customers satisfaction is not so responsive.

As for (Negi, 2009 ) the importance of Customers satisfaction on commercial Banks in Rwanda (well above 70%) were aware of the financial services therein. However, some of the domestic services were not well known especially by the medium and small financial services. Specifically, services such as issuance of withholding finance (43.9%), privileged persons refund (36.1%), appeal process (47.9%), finance arrears certificate (54.8%), automatic VAT refund (54.2%) and non-automatic refund (43.7%) need more emphasis to enable taxpayers to understand and be able to use them. Impliedly, categories of taxpayers who were not aware of these services were not equally appreciative of the services.

III. Materials and Methodology

This study adopted a research philosophy from the empirical literature, hinged on two prominent research paradigms: positivistic and deductive philosophical approach. The positivistic approach is quantitative and based upon values of reason, truth, and validity. The focus is purely on facts gathered through direct observation and experience and measured empirically using quantitative survey methods, experiments, and statistical analysis (Erickson & Kovalainen, 2008). Positivism maintains that knowledge should be based on real facts, not on the abstractions.

### III.1 Research Design

A research design is a plan or an overall strategy for conducting the research. It is a means of ensuring that a research process is systematic and scientific enough so that the results obtained can be applied in real life (Prabhat & Meenu M., 2015). This study was mainly descriptive research. Descriptive research studies are those studies, which are concerned with describing the characteristics of a particular individual or characteristic of a group, (Kothari, 2004).

For (Mugenda & Mugenda, 2003), on the other hand, define descriptive research as a process of collecting data to gain insight on the data patterns and answer questions concerning the status of the subject of study. (Sekaran, 2003), also contends that a descriptive study is undertaken to ascertain and be able to describe the characteristics of the variables of interest in a situation; A descriptive survey design was adopted for this study because; first, it was used to quantitatively describe specific aspects of the population. Finally, the study data used a sample of the population from Commercial Banks by utilizing questionnaires, from which research findings were generalized to the population.

### III.2 Target population

The target population is an aggregation of study elements and refers to all members of a real or hypothetical set of people, events, or objects to which researcher wish to generalize the findings (Prabhat & Meenu M., 2015); The target population for the study was 829 from Bank of Kigali, Bank Populaire du Rwanda, I & M Bank, Cogebanque, Ecobank, KCB, Equity Bank, GT-Bank, Access Bank, and CraneBank (BCR) in financial activities operating in the period of 2011-2019 which means that some of these Commercial Banks were started its performance activities in Rwanda in the formentioned period with a sample size of 270 given after statistic calculation.

<table>
<thead>
<tr>
<th>Targeted Banks</th>
<th>Target Population</th>
<th>Proportion (%)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank of Kigali</td>
<td>95</td>
<td>11.46</td>
<td>31</td>
</tr>
<tr>
<td>Bank Populaire du Rwanda</td>
<td>94</td>
<td>11.34</td>
<td>30</td>
</tr>
<tr>
<td>I &amp; M Bank</td>
<td>85</td>
<td>10.25</td>
<td>28</td>
</tr>
<tr>
<td>Cogebanque</td>
<td>85</td>
<td>10.25</td>
<td>28</td>
</tr>
<tr>
<td>Ecobank</td>
<td>75</td>
<td>9.04</td>
<td>24</td>
</tr>
<tr>
<td>KCB</td>
<td>85</td>
<td>10.25</td>
<td>28</td>
</tr>
<tr>
<td>Equity</td>
<td>80</td>
<td>9.25</td>
<td>26</td>
</tr>
<tr>
<td>GT-Bank</td>
<td>85</td>
<td>10.25</td>
<td>28</td>
</tr>
<tr>
<td>Access Bank</td>
<td>75</td>
<td>9.04</td>
<td>24</td>
</tr>
<tr>
<td>Crane Bank (BCR)</td>
<td>70</td>
<td>8.44</td>
<td>23</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>829</strong></td>
<td><strong>100</strong></td>
<td><strong>270</strong></td>
</tr>
</tbody>
</table>
The selected sample units show a general representation of other Commercial Banks Organs in the study area that operate in different business activities (sectors).

III.3 Sampling Frame
The sampling frame was designed to cover Commercial Banks officials such as DGs, CEOs, Directors, Head of Units, Specialists, Experts, Professionals from Rwanda. A study sample is a subgroup or a fraction of the target population and is a representation of the study population (Roger, 2011); Multistage sampling was used in this study; This was followed by systematic random sampling, by using random number table digits to identify the respondent; The next step involved the selection of the respondents from the sampling frame of potential respondents from each targeted institution.

III.4 Sampling Technique
The sample size is the number of individuals from whom the researcher obtains the required information and is usually denoted by the letter n. The respondents for this study were the Experts from Bank of Kigali, Bank Populaire du Rwanda, I &M Bank, Cogebanque, Ecobank, KCB, Equity, GT-Bank, Access Bank, and CraneBank (BCR); In determining the sample size, this study adopted the formula and procedure for categorical data using the Fishers formula; According to (Singh & Masuku, 2014) reformulated the formula of Yamane 1967, provided a simplified formula to calculate the said sample sizes as below.

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

Where n is the sample size, N is the population size, and e is the level of precision 5% for our study

Thus, \[ \frac{N}{1 + N(e^2)} = \frac{270}{1 + 270(0.05)^2} = 269.7 \]

As for (Singh et al, 2014) added that the proportional stratified sample size means that the number of sampling units drawn from each stratum is in the proportion to the relative population size of that stratum.

III.5 Data Collection Instruments
According to (Kothari, 2004) questionnaires are popularly used data collection tools. Primary data was collected using structured to have a broad range of data to enhance data accuracy.

III.5.1 Primary Data
Primary data was collected from 270 officials from different Commercial Banks such as Bank of Kigali, Bank Populaire du Rwanda, I &M Bank, Cogebanque, Ecobank, KCB, Equity, GT-Bank and Access Bank, and CraneBank (BCR) operating in Rwanda.

III.5.2 Secondary Data

III.6 Data collection procedures
According to (Creswell & Garrett, 2008), defined data collection as the process of gathering and measuring information on variables of interest in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes. For this study, primary data was collected by administering questionnaires face to face and via e-mail. 270 questionnaires were distributed to the different officials from the commercial Banks.

III.6.1 Validity Test of Research Instrument
Validity is about the accuracy of the data obtained in the study in representing the variables of the study (Saunders, 2015), defined validity as to how well an instrument measures what it is intended to measure. The study used open-ended and close-ended questionnaires with Likert scale; Another important feature is the population for which the measure is intended, once some of these decisions were made and a measure was developed. This study established the validity of the research instrument with the help of the university supervisors and the pilot testing; In this study, the following measures were put place to ensure the items in the questionnaire produced valid data.

III.6.2 Data Analysis and Presentation

III.7.1. Data analysis
To support the relationships as suggested in the model, the study used statistical and econometrics Package for Social Sciences (SPSS version 21) to analyze the perception, multinominal model, and descriptive analysis. First, the researcher analyzed internal correlations to analyze the contribution among the research variables. Second, the researcher conducted a standard multiple regression analysis to test for the direct contribution of the independent variables on customers’ satisfaction of commercial banks in Rwanda with its indicators such as Satisfaction Rate (SR) and Customer Effort Score (CES).

III.7.2 Data Analysis and Presentation
The Data analysis was conducted according to the research objectives and hypotheses; This included the need to analyze the contribution of the contribution of Assets Management Strategies and Customer Satisfaction of Commercial Banks based on different Institutions of Rwanda; Before processing the responses, data preparation was done on the completed questionnaires by editing, coding, entering, and cleaning the data.

III.8 Model specification

III. 8.1 Multiple Linear Regression Model
The study employed a multiple linear regression model given by equation below

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

Without the moderator

Where:

i. \( Y \): Customers satisfaction of commercial banks in Rwanda

ii. \( X_1 \): Asset Portfolio Risk;

iii. \( X_2 \): Risk management strategies ;

iv. \( X_3 \): and Asset performance measures,

v. \( Z \): Prudential regulations
v. $\beta_0$: Coefficient of Intercept
vi. $\beta_1$ – $\beta_3$: The corresponding coefficients for the respective independent variables for Asset management strategies
vii. $\epsilon$: error term

The linear regression model is based on the following assumptions; the randomness of the error term, assumption of zero means of the error term, the assumption of constant variance, and assumption of normality of the variables. (Robert & Lachlan, 2014) emphasize that regression methods have become an integral component of any data analysis concerned with describing the relationship between a response variable and one or more explanatory variables; The data were obtained from the questionnaires are the primarily quantitative analyzed to identify the most statistically significant contribution of Asset management strategies (Asset Portfolio Risk; Risk management strategies and Asset performance measures,) with the variables of Asset management strategies and customers satisfaction of commercial banks in Rwanda.

III.9 Test of Hypotheses

According to (Creswell & Garrett, 2008) the ANOVA was used to determine whether there are significant differences between independent variable’s pillars of assets management strategies on customer satisfaction of commercial banks in Rwanda at a selected probability level; The conclusion is based on the p-values where, if the null hypothesis is rejected then the overall model is significant and if null hypothesis fails to be rejected the overall model is insignificant. The null hypothesis with a p-value greater than 0.05 was rejected and the p-value less than 0.05 we failed to be rejected.

III.10 Statistical and econometric technique

Both econometrics and statistics allowed the researcher to analyze, present, and interpret data; the output was leading the researcher to show the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks.

IV Data analysis and interpretation of the contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks

IV.1 Response Rate

The survey was conducted in 2020 covering commercial banks in Rwanda. 270 structured questionnaires were distributed to the DGs, CEOs, Directors, Head of Units, Specialists, Experts, and Professionals. Out of the 270 questionnaires, 270 were filled and returned. This represented 100% response rate. This response rate is considered excellent to make conclusions for the study. (Mugenda & Mugenda, 2003), observed that a 50% response rate is adequate, 60% good 70% rated very good and above 95% excellent.

The response rate of 100% is therefore excellent. The recorded high response rate can be attributed to the data collection procedure. Then, pre-notified the potential participants of the intended survey utilized a self-administered questionnaire where the respondents completed the questionnaires. The questionnaires were picked shortly after follow up calls to clarify queries as well as prompt respondents to fill the questionnaires.

IV.2 Demographic information

This section presents the demographic characteristics such as gender, level of education, year worked in the organizations, organization size and number of years’ institutions and organization’s has been in existent.

IV.2.1 Respondents Gender distribution

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>158</td>
<td>58.5</td>
</tr>
<tr>
<td>Male</td>
<td>112</td>
<td>41.6</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

On the table2. 1; out of 270 respondents who returned all the questionnaires distributed 58.52% were the Females and 41.48% were the Males. This implies that females were the majority of the researcher’s respondents whom were implying that they are the majority heading the commercial banks in Rwanda.

IV.2.2 The Level of Education

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universities</td>
<td>225</td>
<td>83.3</td>
</tr>
<tr>
<td>level Postgraduate</td>
<td>45.6</td>
<td>16.6</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

On the table 4. 2; The Respondents’ qualifications varied greatly with a higher proportion of employees having university level education at 83.3%. Post University at 16.7% which demonstrate that the respondents of the commercial banks were skilled with knowledge.

IV.2.3 The Working Experiences in the commercial Banks
On the table 2.3, The years worked distribution were that majority had worked for over 5 years 99.2%, while 1.0% of respondents worked with those commercials between 3 and 5 years.

IV.2.4 Type of Commercial Banks Institutions or Organizations

In the table 2.4 above, 99.2% of respondents were from the Mixt Commercial Bank, 0.8% were from The lending of Funds Commercial Bank and 0.0% were from Accepting Deposits Commercial Bank prospectively equal proportion.

IV.2.5 Life of institutions

The results from table 2.5 indicates that 98.1% of respondents indicated that their Commercial Banks have been in operation for years between 11 and 15 years, 1.5% between 6 to 10 years, 0.4% for over 15 years.

IV.2.6 Commercial banks faced financial leadership component

The findings from table 2.6 show that 97% of respondents said that their institutions faced the commercial bank face one of these three financial leadership component (Management efficiency, management systems, management capacities, and prudential regulations) towards working capital of commercial banks.

IV.3 The contribution of Asset Portfolio Risk on the Customer Satisfaction of Commercial Banks.

In the table 2.5 above, 98.1% of respondents were from the Mixt Commercial Bank, 0.8% were from The lending of Funds Commercial Bank and 0.0% were from Accepting Deposits Commercial Bank prospectively equal proportion.

IV.3.1 The Asset management strategies supported by its pillar of Asset Portfolio Risk is improving positively on the Customer Satisfaction of Commercial Banks.

The results from table 3.1 indicate that among 270 respondents, 48.1% of respondents disagreed the statement that the Asset management strategies supported by its pillar of Asset Portfolio Risk is improving positively on the Customer Satisfaction of Commercial Banks, 32.6% agreed that the perception to the Asset management strategies supported by its pillar of Asset Portfolio Risk is improving positively on the Customer Satisfaction of Commercial Banks, 17.5 strongly agreed.
the perception to the Asset management strategies supported by its pillar of Asset Portfolio Risk is improving positively on the Customer Satisfaction of Commercial Banks and 1.7% strongly agreed that the Asset management strategies supported by its pillar of Asset Portfolio Risk is improving positively on the Customer Satisfaction of Commercial Banks

**IV.3.2 Investment Management as part of Management efficiency should improve the working capital of commercial banks in Rwanda**

The Respondent’s perception to Investment Management as part of Management efficiency should improve the working capital of commercial banks in Rwanda remain constant. Their responses were summarized in the table below.

**Table 3.2: The Personalized Portfolio Management as part of Asset Portfolio Risk should improve the Customer Satisfaction of commercial banks in Rwanda**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>33</td>
</tr>
<tr>
<td>Agree</td>
<td>123</td>
</tr>
<tr>
<td>Disagree</td>
<td>114</td>
</tr>
<tr>
<td>Total</td>
<td>213</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

On the table 3.2. Shows that, among 270 respondents 45.6% agreed the statement that The Personalized Portfolio Management as part of Asset Portfolio Risk should improve the Customer Satisfaction of commercial banks in Rwanda, 42.2% disagreed the statement while 12.2% strongly agreed that The Personalized Portfolio Management as part of Asset Portfolio Risk should improve the Customer Satisfaction of commercial banks in Rwanda.

**IV.3.3 The Active Asset portfolio Management brought new strategies which assisting on the achievement of Customer Satisfaction commercial banks in Rwanda**

This question brought to check perception of respondents to the Active Asset portfolio Management brought new strategies which assisting on the achievement of Customer Satisfaction of commercial banks in Rwanda.

**Table 3.3: The Active Asset portfolio Management brought new strategies which assisting on the achievement of Customer Satisfaction of commercial banks in Rwanda**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>20</td>
</tr>
<tr>
<td>Agree</td>
<td>140</td>
</tr>
<tr>
<td>Disagree</td>
<td>110</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

On the Table 3.3, 51.2% supported the statement that the Active Asset portfolio Management brought new strategies which assisting in the achievement of Customer Satisfaction commercial banks in Rwanda while 8% strongly supported the statement The Active Asset portfolio Management brought new strategies which assisting in the achievement of Customer Satisfaction commercial banks in Rwanda.

**IV.4 The impact of Risk management strategies on the Customer Satisfaction of Commercial Banks**

This section focuses on the results of the research on the impact of Risk management strategies on the Customer Satisfaction of Commercial Banks.

**IV.4.1 The Risk management strategies well oriented assisted on the improvement of Satisfaction Rate (SR) and Customer Effort Score (CES) as indicators of customers satisfaction of commercial banks**

The Respondents perception to The Risk management strategies well oriented assisted on the improvement of Satisfaction Rate (SR) and Customer Effort Score (CES) as indicators of customers satisfaction of commercial banks. Their responses are summarized in the table below.

**Table 4.1: The Risk management strategies well oriented assisted on the improvement of Satisfaction Rate (SR) and Customer Effort Score (CES) as indicators of customers satisfaction of commercial banks**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>6</td>
</tr>
<tr>
<td>Agree</td>
<td>253</td>
</tr>
<tr>
<td>Disagree</td>
<td>9</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

On the table 4.1. Among 270 respondents, 93.7% of the respondents agreed on the statement that The Risk management strategies well oriented assisted on the improvement of Satisfaction Rate (SR) and Customer Effort Score (CES) as indicators of customers satisfaction of commercial banks, 2.2% of the respondents strongly agreed, 3.3% disagreed on the statement that The Risk management strategies well oriented assisted on the improvement of Satisfaction Rate (SR) and Customer Effort Score (CES) as indicators of customers satisfaction of commercial banks, and 0.7% strongly disagreed on the same statement that The Risk management strategies well oriented assisted on the improvement of Satisfaction Rate (SR) and Customer Effort Score (CES) as indicators of customers satisfaction of commercial banks.

**IV.4.2 The Proactive design well oriented on management system supported by its component which affects the customer satisfaction of commercial banks in Rwanda**

During the research, there were assessment on the proactive design well oriented on management system supporting its component which affecting the customer satisfaction of commercial banks in Rwanda.

**Table 4.2: The Proactive design well oriented on management system supporting its component which affects the customer satisfaction of commercial banks in Rwanda**
**IV.4.3 Strong Business process improvement plays a critical role in ensuring Banks stay financially adaptable and able to build resilience and sustainability in today’s fierce market.**

During the research, there were assessments on strong business process improvement that plays a critical role in ensuring banks to stay financially adaptable and able to build resilience and sustainability in today’s fierce market.

**Table 4.3: Strong Business process improvement plays a critical role in ensuring banks to stay financially adaptable and able to build resilience and sustainability in today’s fierce market.**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>129</td>
</tr>
<tr>
<td>Agree</td>
<td>95</td>
</tr>
<tr>
<td>Disagree</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

The results from the table 4.3 indicates that 47.8% of respondents’ Strong Business process improvement plays a critical role in ensuring Banks stay financially adaptable and able to build resilience and sustainability in today’s fierce market, 35.2% agreed that Strong Business process improvement plays a critical role in ensuring banks to stay financially adaptable and able to build resilience and sustainability in today’s fierce market.; while 17% disagreed on the statement that strong business process improvement that plays a critical role in ensuring Banks to stay financially adaptable and able to build resilience and sustainability in today’s fierce market.

**IV.5. The effect of Asset performance measures on the Customer Satisfaction of Commercial Banks.**

This section aims to establish the views of respondents on the effect of Asset performance measures on the Customer Satisfaction of Commercial Banks. The table 4.10 shows the respondents perspectives to the strategy.

**IV.5.1 The Asset performance measures well oriented should support on the Satisfaction Rate (SR) and Customer Effort Score (CES) achievement.**

**Table 5.1: The Asset performance measures well oriented should support on the Satisfaction Rate (SR) and Customer Effort Score (CES) achievement.**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>130</td>
</tr>
<tr>
<td>Agree</td>
<td>130</td>
</tr>
<tr>
<td>Disagree</td>
<td>8</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

The results from the table 4.13, 48.5% strongly agreed supported the statement that The Asset performance measures well oriented should support on the Satisfaction Rate (SR) and Customer Effort Score (CES) achievement, 48.5% agreed that The Asset performance measures well oriented should support on the Satisfaction Rate (SR) and Customer Effort Score (CES) achievement, 3% disagreed and 0.9% strongly disagreed that The Asset performance measures well oriented should support on the Satisfaction Rate (SR) and Customer Effort Score (CES) achievement.

**IV.5.2 The Rate of Return Calculations under Asset performance measures are used to strengthen the efficiently of the customers’ satisfaction in commercial banks**

The researcher tried to find out deferent sights of respondents on how The Rate of Return Calculations under Asset performance measures are used to strengthen the efficiently of the customers’ satisfaction in commercial banks.

**Table 5.2: The Rate of Return Calculations under Asset performance measures are used to strengthen the efficiently of the customers’ satisfaction in commercial banks**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>141</td>
</tr>
<tr>
<td>Agree</td>
<td>106</td>
</tr>
<tr>
<td>Disagree</td>
<td>19</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

From the table 5.2 above, out of 270 responded, 50.3% of respondents strongly agreed that the Rate of Return Calculations under Asset performance measures are used to strengthen the efficiently of the customers’ satisfaction in commercial banks, 39.3% of the respondents agreed that The Rate of Return Calculations under Asset performance measures are used to strengthen the efficiently of the customers’ satisfaction in commercial banks, 7% of respondents disagreed and only 3.4% of respondent strongly disagreed that The Rate of Return Calculations under Asset performance measures are used to strengthen the efficiently of the customers’ satisfaction in commercial banks.
IV.5.3 Risk-Adjusted Measures of Performance of Asset performance measures increase the capacity of customers satisfaction the commercial banks in Rwanda

The Respondents’ perception on Risk-Adjusted Measures of Performance of Asset performance measures increase the capacity of customers satisfaction the commercial banks in Rwanda. Their responses are summarized in the table below.

Table 5.3: the Risk-Adjusted Measures of Performance of Asset performance measures increase the capacity of customers satisfaction of the commercial banks in Rwanda

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>115</td>
<td>41.1</td>
</tr>
<tr>
<td>Agree</td>
<td>126</td>
<td>46.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>20</td>
<td>7.4</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>8</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

In the table 5.3 above, 41.1% of the respondent strongly agreed on concept that the Risk-Adjusted Measures of Performance of Asset performance measures increase the capacity of customers satisfaction of the commercial banks in Rwanda. 46.0% of the respondents agreed that the Risk-Adjusted Measures of Performance of Asset performance measures increase the capacity of customers satisfaction of the commercial banks in Rwanda. 7.4% of respondents disagreed on concept while 2.5% strongly disagreed on the Risk-Adjusted Measures of Performance of Asset performance measures increase the capacity of customers satisfaction the commercial banks in Rwanda.

IV.6. The effect of Prudential regulations on the Asset management stratégies and customers satisfaction of commercial banks in Rwanda.

This section focuses on the results of the research on moderating The effect of Prudential regulations on the Asset management stratégies and customers satisfaction of commercial banks in Rwanda.

IV.6.1. The Prudential regulations well oriented is supporting the customers satisfaction of commercial banks

It is interesting to find out the perception of different respondents on the Prudential regulations well oriented in supporting the customers satisfaction of commercial banks.

Table 6.1: The Prudential regulations well oriented is supporting the customers satisfaction of commercial banks

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>100</td>
<td>39.4</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The data presented in the table 6.1 above indicate that 45% of respondents agreed that the prudential regulations well oriented is supporting the customers satisfaction of commercial banks. 39.4% disagreed that The Prudential regulations well oriented is supporting the customers satisfaction of commercial banks. 9.3% of respondents strongly disagreed that The Prudential regulations well oriented is supporting the customers satisfaction of commercial banks while 7.3% of respondents strongly disagreed that the Prudential regulations well oriented is supporting the customers satisfaction of commercial banks.

IV.7.2. The strong Monetary Policy prescribed by the Central Bank regulate in the management of customers satisfaction of commercial banks

The researcher was also interested in finding out how the strong Monetary Policy prescribed by the Central Bank regulates in the management of customers satisfaction of commercial banks. The findings were summarized in the table below.

Table 7.2: The strong Monetary Policy prescribed by the Central Bank regulates in the management of customers satisfaction of commercial banks

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>34</td>
<td>12.6</td>
</tr>
<tr>
<td>Agree</td>
<td>210</td>
<td>77.8</td>
</tr>
<tr>
<td>Disagree</td>
<td>25</td>
<td>9.3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

On the table 7.2, 77.8% agreed that The strong Monetary Policy prescribed by the Central Bank regulates the management of customers satisfaction of commercial banks, 34 respondents or 12.6% strongly agreed that the strong Monetary Policy prescribed by the Central Bank regulates the management of customers satisfaction of commercial banks, 9.3% of respondents disagreed to the concept that the strong Monetary Policy prescribed by the Central Bank regulates the management of customers satisfaction of commercial banks. 0.4% of respondents strongly disagreed that the strong Monetary Policy prescribed by the Central Bank regulates the management of customers satisfaction of commercial banks.

IV.7.3 The Monetary regulation under the Prudential regulations should stay the main component assisting in the realization of the customers satisfaction of commercial banks in Rwanda

The Respondents gave their view on areas of The Monetary regulation under the Prudential regulations should stay the main component assisting in the realization of the customers satisfaction of commercial banks in Rwanda.

Table 7.3: The Monetary regulation under the Prudential regulations should stay the main component assisting in the realization of the customers’ satisfaction of commercial banks in Rwanda

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agree</td>
<td>130</td>
<td>45.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>25</td>
<td>9.3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>7</td>
<td>7.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The data presented in the table 7.3 above indicate that 45% of respondents agreed that the monetary regulation under the prudential regulations should stay the main component assisting in the realization of the customers satisfaction of commercial banks, 9.3% of respondents disagreed that The Monetary regulation under the Prudential regulations should stay the main component assisting in the realization of the customers satisfaction of commercial banks while 7.4% of respondents strongly disagreed that the Monetary regulation under the Prudential regulations should stay the main component assisting in the realization of the customers satisfaction of commercial banks.
To realize the performance of Commercial Banks projection, it is interesting to find out the perception of different respondents on the importance of the Monetary regulation and Prudential regulations in assisting the realization of the customers satisfaction of commercial banks in Rwanda. 12.7% of respondents strongly agreed the statement that the Monetary regulation under the Prudential regulations should stay the main component assisting in the realization of the customers satisfaction of commercial banks in Rwanda.

### IV.8.1. The customers satisfaction has an importance role on performance of Commercial Banks projection

It is interesting to find out the perception of different respondents how the customers satisfaction has an importance role on performance of Commercial Banks projection.

The data presented in the table 8.1 above indicate that 50% of respondents agreed that The customers satisfaction has a contribution role on performance of Commercial Banks projection, 40.4% strongly agreed on same statement, 9.3% disagreed that The customers satisfaction has an importance role on performance of Commercial Banks projection while 0.4% of respondents strongly disagreed that The customers satisfaction has a contribution role on performance of Commercial Banks projection.

### IV.8.2. The Satisfaction Rate (SR) is a strong indicator of customers satisfaction in contribution of the performance of commercial banks

The researcher was also interested in finding out how the Satisfaction Rate (SR) is a strong indicator of customers satisfaction to make the performance of commercial banks. The findings were summarized in the table below.

#### Table 8.2: The Satisfaction Rate (SR) is a strong indicator of customers satisfaction to realize the performance of commercial banks

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>109</td>
<td>40.4</td>
</tr>
<tr>
<td>Agree</td>
<td>135</td>
<td>50.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>25</td>
<td>9.3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

**Source:** Primary data, 2020

The results from table 7.3 indicates that 75% of respondents agreed the statement that the Monetary regulation under the Prudential regulations should stay the main component assisting in the realization of the customers satisfaction of commercial banks in Rwanda, 8.9% of respondent disagreed the statement while 5.4% strongly disagreed the statement that the Monetary regulation under the Prudential regulations should stay the main component assisting in the realization of the customers satisfaction of commercial banks in Rwanda.

#### IV.8.3 The Customer Effort Score (CES) is a strong indicator of customers satisfaction make the realization of performance of commercial banks

The Respondents gave their view on areas of The Customer Effort Score (CES) is a strong indicator of customers satisfaction make the realization of performance of commercial banks.

**Source:** Primary data, 2020

On the table 8.2, 75.8% agreed that The Satisfaction Rate (SR) is a strong indicator of customers satisfaction to realize the performance of commercial banks, 34 responds or 11.6 % strongly agreed to the concept that The Satisfaction Rate (SR) is a strong indicator of customers satisfaction to realize the performance of commercial banks. The 4.4% of respondents strongly disagreed the concept that The Satisfaction Rate (SR) is a strong indicator of customers satisfaction to realize the performance of commercial banks, while 4.4% of respondents strongly disagreed the concept that The Satisfaction Rate (SR) is a strong indicator of customers satisfaction to realize the performance of commercial banks.

**Table 8.3:** The Customer Effort Score (CES) is a strong indicator of customers satisfaction make the realization of performance of commercial banks,
The results from table 8.3 above indicates that 77% of respondents agreed the statement that The Customer Effort Score (CES) is a strong indicator of customers satisfaction make the realization of performance of commercial banks, 13.7% of respondents strongly agreed the statement that The Customer Effort Score (CES) is a strong indicator of customers satisfaction to realize the performance of commercial banks while 0.4% strongly disagreed the statement that The Customer Effort Score (CES) is a strong indicator of customers satisfaction to realize the performance of commercial banks.

The researcher used this module to provide his contribution based on the findings and the module given in the Methodology.

4.9.1. Joint Model Summary: Analyze the Contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks in Rwanda in term of Satisfaction Rate (SR)

Regression analysis was used to establish the Contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks in Rwanda in term of Satisfaction Rate (SR) Precisely, the following linear model was used:

\[ Y_{\text{Satisfaction Rate (SR)}} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon \]

Where; \( Y \) stands for Satisfaction Rate (SR) while \( \beta_0 \) is the intercept (a constant), \( \beta_1, \beta_2, \text{ and } \beta_3 \) are the slopes associated to the independent variables \( X_1, X_2, \text{and } X_3 \) and \( \epsilon \) is the error term which is assumed to be independent, identical and normally distributed random variable with a zero mean and a constant variance. In this study, \( X_1 \) denotes Asset Portfolio Risk, \( X_2 \) denotes Risk management strategies, and \( X_3 \) denotes Asset performance measures. The findings were tabulated as shown in Table 4.21

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. coefficient</th>
<th>t-tatistics</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Portfolio Risk</td>
<td>0.531</td>
<td>0.053</td>
<td>0.312</td>
<td>4.76</td>
</tr>
<tr>
<td>Risk management strategies</td>
<td>0.623</td>
<td>0.062</td>
<td>0.032</td>
<td>0.527</td>
</tr>
<tr>
<td>Asset performance measures</td>
<td>0.721</td>
<td>0.063</td>
<td>0.092</td>
<td>1.353</td>
</tr>
<tr>
<td>R</td>
<td>0.737</td>
<td>Mean dependent variable</td>
<td>3.52</td>
<td></td>
</tr>
</tbody>
</table>
Table 9.1 displays the summary of the model used which assessed its best fit to the data and its coefficient estimates in an attempt to investigate the effect between financial leadership and working capital in terms of Satisfaction Rate (SR). From table 9.1, column 2, it is observed that $R^2$ which is the models goodness of fit for the regression line obtained is 0.708 which means that 70.8% of variation in the dependent variable - Satisfaction Rate (SR) is being explained by the variation in independent variable - financial leadership with only 29.2% of the variation in dependent variable being attributed to the error-term introduced in the theoretical model or other variables other than financial leadership explaining working capital of commercial banks.

$$Y = 1.999 + 0.531X_1 + 0.623X_2 + 0.721X_3 + 0.002E$$

Where $Y$ as a Satisfaction Rate (SR), $X_1$ is Asset Portfolio Risk; $X_2$ is Risk management strategies $X_3$ is Asset performance measures systems. From the above equation, it can be observed in column 2 that there is a positive unstandardized beta coefficient of 0.531 for $X_1$ (Asset Portfolio Risk), 0.623 from $X_2$ (Risk management strategies) and 0.721 for $X_3$ (Asset performance measures systems).

This indicates that a unit change in Asset Portfolio Risk should increase in mean the working capital in terms of Satisfaction Rate (SR) of the performance of Commercial Bank in Rwanda by 0.531 units from 1.999 when keeping Risk management strategies and Asset performance measures systems constant; A unit change in Risk management strategies should increase in mean the customer satisfaction in terms of Satisfaction Rate (SR) of the Commercial Bank in Rwanda by 0.623 units from 1.999 when keeping Asset performance measures systems and Risk management strategies constant lastly A unit change in Asset performance measures systems should increase customer satisfaction in terms of Satisfaction Rate (SR) of the Commercial Bank in Rwanda by 0.721 units from 1.999 when keeping Asset Portfolio Risk and Risk management strategies constant.
However, the model indicates that Asset performance measures systems ($\beta=0.721$) contributes more, followed by Risk management strategies ($\beta=0.623$) and lastly Asset Portfolio Risk ($\beta=0.531$) respectively in contributing to the increase of the customer satisfaction of commercial banks in Rwanda. With a p-value of 0.002< 0.05, This indicates that the model used is a best fit for the data used, given all assumptions of normality underlying the model, in the column 6, it can be concluded by said that the Asset management strategies has a statistically contribution on customer satisfaction of commercial banks in Rwanda ($F=13.991$, $R^2 = 0.708$, Sig=0.002 at $\alpha=0.05$).

Table 9.2 : Analyze the Contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks in Rwanda in term of The Customer Effort Score (CES)

<table>
<thead>
<tr>
<th>Dependent Variable: the Contribution of Assets Management Strategies on the Customer Satisfaction of Commercial Banks in Rwanda in term of The Customer Effort Score (CES)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample: 270</td>
<td></td>
</tr>
<tr>
<td>Included Observations: 270</td>
<td></td>
</tr>
<tr>
<td>I. Variable: WC</td>
<td>Coefficient</td>
</tr>
<tr>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1(Constant)</td>
<td>17.035</td>
</tr>
<tr>
<td>Asset Portfolio Risk Management systems, X_3 is Management capacities</td>
<td>0.510</td>
</tr>
<tr>
<td>Risk management strategies</td>
<td>0.655</td>
</tr>
<tr>
<td>Asset performance measures systems</td>
<td>0.768</td>
</tr>
<tr>
<td>R</td>
<td>0.711</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.711</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.642</td>
</tr>
<tr>
<td>F-statistics</td>
<td>5.259</td>
</tr>
<tr>
<td>Prob(F-statistic)</td>
<td>0.003</td>
</tr>
</tbody>
</table>
a. Predictors: (Constant), Asset Portfolio Risk; Risk management strategies and Asset performance measures systems
b. Dependent Variable: The Customer Effort Score (CES)

ANOVA*

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>2780.863</td>
<td>4</td>
<td>695.216</td>
<td>5.264</td>
<td>.003b</td>
</tr>
<tr>
<td>Residual</td>
<td>34998.654</td>
<td>265</td>
<td>132.070</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>37779.517</td>
<td>269</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: The Customer Effort Score (CES)

Table 9.2 displays the summary of the model used which assessed its best fit to the data and its coefficient estimates in an attempt to investigate the contribution between Asset management strategies and customer satisfaction in terms of the Customer Effort Score (CES). The correlation coefficient, denoted in table 9.2, column 2 by R², illustrates that the regression equation deduced a Durbin Watson statistic of 1.776 < 2 which indicates that there is a positive serial of correlation among the observation. Same table illustrated that the regression equation deduced to understand this effect which was:

\[ Y \text{ the Customer Effort Score (CES)} = 17.035 + 0.510X_1 + 0.655X_2 + 0.768X_3 + 0.003E \]

Where Y on the Customer Effort Score (CES) illustrates the involvement of X₁ as Asset Portfolio Risk, X₂ as Risk management strategies and, X₃ as Asset performance measures systems. From the above equation, this indicates that a unit change in Asset Portfolio Risk should increase in mean the customer satisfaction in terms of the Customer Effort Score (CES) of the Commercial Bank in Rwanda by 0.510 units from 17.035 when keeping Risk management strategies and Asset performance measures systems constant; A unit change in Risk management strategies should increase in mean the customer satisfaction in terms of the Customer Effort Score (CES) of Commercial Bank in Rwanda by 0.655 units from 17.035 when keeping Asset Portfolio Risk and Asset performance measures systems constant and finally a unit change in Asset performance measures systems should increase in mean the customer satisfaction in terms of the Customer Effort Score (CES) of the Commercial Bank in Rwanda by 0.768 units from 17.035 when keeping Asset Portfolio Risk and Risk management strategies.

However, the statistic model indicates that Asset performance measures systems (β=0.768) contributes more, followed by Risk management strategies (β=0.655) and lastly Asset Portfolio Risk (β=0.510) respectively in contributing to the customers’ satisfaction in terms of the Customer Effort Score (CES) of Commercial Bank in Rwanda. With a p-value of 0.003< 0.05, This indicates that the model used is a best fit for the data used, given all assumptions of normality underlying the model. in column 6, it can be concluded that customers’ satisfaction has an econometrics and statistically effect on customers’ satisfaction of commercial banks.
commercial Bank (Asset Portfolio Risk) Rwanda (F=5.264, R² = 0.711, Sig=0.003 at α=0.05).

V. Conclusion and Recommendation

V.1 Conclusion

From the findings it was observed that majority of respondents were from the Mixt Commercial Bank at 99.6%. The findings also revealed the majority of respondents being Female at 58.52%, the majority of 99.2%, have been in their positions between over 5 years. The highest level of education for the majority respondents is university degree with 83.3%, with each institution surveyed having a combined workforce was between 50 to 199 (78.2%); The study established a number of findings and they are summarized per objective.

The researcher findings demonstrate that Asset performance measures systems have strong effect where the econometrics and statistical analysis shows a strong effect on customers satisfaction of commercial banks in Rwanda with (β=0.721) on Satisfaction Rate (SR), (β=0.768) on the Customer Effort Score (CES). Based on these findings, the researcher approved the first hypothesis of this Study with the assumption of H0 and reject the second ones of H1; The Same findings demonstrate that the Risk management strategies plays a positive effect on customers satisfaction of Commercial banks in Rwanda. The econometrics and statistical analysis shows the positive contribution of Asset management on customers satisfaction of Commercial banks in Rwanda with (β= 0.623) on Satisfaction Rate (SR) and (β=0.655) on Customer Effort Score (CES). The researcher approved the first hypothesis of this Study with the assumption H0 and rejected the second one H1; The researcher findings demonstrate that the Asset Portfolio Risk has a good contribution on customers satisfaction of commercial banks in Rwanda where the econometrics and statistical analysis shows the ties contribution of Asset Portfolio Risk with (β=0.531) on Satisfaction Rate (SR), (β=0.510) on Customer Effort Score (CES). The researcher approved the first hypothesis of this Study with the assumption of H0 and reject the second ones of H1.

V.2. Recommendation

The Researcher recommends that the competition and consumption protection policy in its nature, should promotes equality by providing fair business framework and with efficient and effective implementation in where economic operators are to get the same opportunities and chances to compete with each other.

Basing on the study findings, the study recommended that the banks should effectively implement and comply with prudential regulations imposed by the regulator due to the nature of the riskiness of the banking sector and its impact on the customer satisfaction of the Country.

The Researcher recommends that a Monitoring of Rwanda’s Asset management strategies on a regular basis should be taken into consideration in order to understanding trends, patterns in Financial sector and provide an opportunity to highlight emerging issues on customers satisfaction of commercial banks.

The Rwandan Central Bank “BNR” should monitor and supervise Commercial Banks in Rwanda to ensure financial reporting, legal and regulatory requirements are met by the banks and transparent periodic reporting to stakeholders on Corporate Governance, Risk Management and Internal Controls is undertaken.

The Researcher recommends that a Monitoring of Rwanda’s asset management strategies on a regular basis should be taken into consideration in order to understanding trends, patterns in financial sector and provides an opportunity to highlight emerging issues on commercial banks. This is fundamental importance to achieve Rwanda’s customers satisfaction of commercial banks in Rwanda.

Areas for Further Research

The period of time used which is 2011 to 2019 in the Researcher’s opinion is not sufficient for such a study and would recommend for a similar study to be conducted in future that covers more years. This might yield more objective results.

The researcher also recommends a study to be carried out in these factors of macro-economic that can give information on the impact those factors on the financial performance of commercial banks in Rwanda. This would yield more objective results on the true impact of prudential regulations on commercial banks.

Another stream of research could be directed towards deep investigations of each constituent part of the conceptual framework, which would ensure a deeper understanding of the framework’s contribution on free movement and cross-border financial cooperation as an element of the Asset management strategies research embedded in another context could address new issues and areas within the field of economic diplomacy, trade promotion, infrastructure development, intelligent growth or support for customers satisfaction of commercial banks market access.

In addition, a deeper understanding of local institutions would allow financial business actors to develop adequate strategies, foresee, and respond proactively to possible difficulties arising from the specifics of the institutional landscape.

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The Effect Analysis Of Financial Leadership On Working Capital Of Commercial Banks In Rwanda

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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p107102

Abstract- This study was to assess the effect analysis of financial leadership on the working capital of commercial banks in Rwanda. To achieve this, the general objective was to analyze the effect of financial leadership on the working capital of commercial Banks in Rwanda. A multimethod approach composed of both qualitative and quantitative research design was used. Data were collected from both primary and secondary sources using questionnaire and documentation were used. A population comprised of 270 from different commercial banks operating in Rwanda. Data were captured using the statistical package for sciences (SPSS 21) and presented into frequency tables. Simple regression and ANOVA analysis were carried out. A significance test ≤ 5% was assumed. The findings indicated that Management capacities have a strong effect where the econometrics and statistical analysis shows a strong effect with (β = 0.831) on Current Asset (CA), and (β = 0.978) on Current liability (CL); The Same findings demonstrate that the Management systems play a positive effect on working capital of Commercial banks where the econometrics and statistical analysis shows the positive effect of Financial leadership with β = 0.827 on Current Asset (CA) and (β = 0.755) on Current liability (CL). Lastly, the findings demonstrate that the Management efficiency has a good effect on the working capital of commercial banks in Rwanda where the econometrics and statistical analysis shows the ties contribution of Management efficiency with (β = 0.541) on Current Asset (CA), (β = 0.502) on Current liability (CL) of working capital of commercial banks

Index Terms- Management efficiency; management systems and management capacities

I. HISTORICAL BACKGROUND

INTRODUCTION

Scholars and practitioners have been analyzing the effect of financial leadership on the working capital of the commercial bank for some years. The Financial leadership such as Management efficiency, management systems, and management capacities in large Financial corporations has been documented to be a key ingredient in the revitalization of commercial Banks as well as in the ongoing management of these larger commercial banks. While the research on commercial banks is clear evidence that financial leadership plays an important role in the success of these commercial banks, there are fewer data to support the idea that financial leadership plays a similarly vital role in other levels of the executive chain, including the management efficiency, policy instrument and financial sector strategies segment, the dearth of research in the whole working capital component such as Cash, Raw materials and inventory, finished goods and Account receivable that surprising to consider the important effect.

I.1 contextual Expansion aspect

The field of finance Leadership and banking administration began in the 1930s with early research on British institutions, such as Sir John Clapham's study on the Bank of England and W. F. Crick and J. E. Wadsworth's research on joint-stock banking. Subsequent on the early-modern period began in the 1950s/1960s, covering topics such as bills of exchange management of English financial revolution, and Italian merchant bankers which brought out a challenge to its growth split between academics in history and Financial history; From the late 1950s, Financial history increasingly became a sub-field of economics, rather than of history, change also coincided with the growing use of quantitative models and cliometric analysis; Meanwhile, historians began to combine the study of economic and social phenomena through the methodologies founded by the Annales Finance School in France. This new discipline paved the way for finance and Social History programs, common at universities in the United Kingdom and Europe in general, (Colvin, 2015).

According to (ICAEW., 2018), demonstrates how in the past, Financial leadership was considered by the Confederation of Asian, Pacific countries, Australia, Northern America, and some European countries as the norm for financial information to be held by the finance people which did not provide a strong effect on the financial performance of commercial banks in world affairs; All too often, there has been a mismatch in policy-making, with economists and policymakers taking the lead in big decisions without involving the finance leaders. Sometimes the finance role has been underplayed when the outcome hasn’t been what policymakers want to see. In contrast, in most private sector companies, from the big corporations down to smaller sized companies, the finance leader is involved in all key decisions.

Today a Strong financial leadership is considering as essential to driving the sustainability of finances with a special core set of the harder technical and organizational skills, and the softer leadership, people, culture, and behavioral skills entering into public-private partnership arrangements that can carry great risks on the macro level, budget decisions and programs sensible and...
sustainable on the financial sector, especially for the development of the Countries. The federal government of the United States has incorporated more elements of business-sector practices in its management approaches, including the use of the CFO position alongside, for example, increased use of the chief information officer post, within public agencies, (Zwilling, 2016)

From the Continent perspective, the development of financial leadership in Africa followed the demand of exchange networks from traditional indigenous finance and economies to colonial exchange with the European world: The establishment of European banking institutions reflected the needs of the capitalist economy introduced by colonialism with the financial management of late nineteenth century and early twentieth century European banks adhered to the interests of shareholders, (Rice, 2013)

According to (Longman, 2015), in the early 20th century, African systems of financial leadership and management were confronted by European modern financial services systems who remained conservative and controlled them as committed to their traditional functions established national central banks and designed to serve the capitalist colonial economies as their penetration linked Africa to the wider world of commercial and imperial expansion in the eighteenth and nineteenth centuries on the continent.

As for (Daniel, 2014) The Africa Finance system supported by the financial leadership prioritizes those sectors which simultaneously offer a significant development impact and an attractive profit potential, to achieve the best return on investment for shareholders and it’s which today the economic services provided by the finance industry encompasses a broad range of businesses that manage money, including credit unions, banks, credit-card companies, insurance companies, accountancy companies, consumer finance companies, stock brokersages, investment funds, individual managers and some government-sponsored enterprises cash, accounts receivable (customers’ unpaid bills) and inventories of raw materials and finished goods, and its current liabilities, such as accounts payable.

From the regional perspective, the origins of the Financial leadership in the East African Community (EAC) can be traced back to the long history of Finance, trade, administrative, and socio-cultural ties between the Partner States, stretching back nearly a century in its present form was formally created to include Kenya, Tanzania, and Uganda in 1999. In 2007, EAC membership was extended to Burundi and Rwanda, (Elke & Craig, 2017)

According to (Sandrey, 2015) The EAC implemented a Customs Union from the beginning of 2005 as a significant milestone achieved with the signing of the Common Market Protocol in November 2009, ratified by all Partner States in April 2010; The agreement envisages the phased liberalization of trade in financial services and the elimination of restrictions on the free movement of capital by 2015 at the latest supported by strong Financial leadership on the achievement of the working capital component such as cash, accounts receivable (customers’ unpaid bills) and inventories of raw materials and finished goods, current liabilities and accounts payable.

For (World Bank., 2014) About 22 multinational and transnational finance corporate such as Kenya Commercial Bank, Equity Bank, Fina Bank, and Commercial Bank of Africa and others owned by EAC members states as a hub are operating in the region; There are four (4) Kenyan banks with a total of 63 branches 35 in Kenya, 16 in Tanzania, 31 in Uganda 16 in Rwanda, 7 in Burundi in 2012.

From a National perspective, the development of the financial leadership in the Financial sector in Rwanda was based on few financial institutions composed of 3 commercial banks and 2 specialized banks operated with a total of fewer than 20 branches in the country, and one microfinance (UBPR) with around 146 branches which the genocide affected heavily the banking sector has resulted in the closure of the Central bank for 4 months, government wealth looted, with two-thirds of the national monetary base in addition to the US $7 million in cash which was taken from the UBPR as consequently, the country took almost a period to reestablish Rwandan financial system, (Ingabe & Kigabo, 2016)

According to the same scholar (Ingabe & Kigabo, 2016) The post-genocide period was marked by an increase in the number of banks, wherein 2010 there were 6 commercial banks with 28 branches, 2 specialized banks, and 1 union of financial institutions (UBPR) with 148 branches, only 7 % of all branches of financial institutions and by the end of 2019, 10 commercial banks, 7 specialized banks, and 34 Microfinance bank were in operations supported by financial leadership.

I.1 Problem Statement

Since 2011, Rwanda coordinated its the Financial sector looking for different financial leadership plans such as Management efficiency, management systems, and management capacities which orienting in the working capital of Commercial Banks with the implementation of the country where it is aiming to become a Middle Income Country (MIC) status by 2035 and High-Income Country (HIC) status by 2050. This has made the Country to be ranked by several international bodies such as International Monetary Fund, World Bank; World Economic Forum on Africa; Easy of Doing Business, (Laure, et al., 2020)

Some studies including (BNR, 2019) (Karembe, 2013) and (BK, 2014) indicate the highest level of despite the widely recognized importance of the Financial Sector and the increased international attention in this area, at which financial leadership operations remains low at domestic level as facing a low level of contribution on her dependent indicators of Liquidity Ratio (LR) Cash Balance (CB), to face the Financial challenges in which should resolve by them.

Based on the above studies, different challenges entitled gaps such as feeble investment in Financial sectors of 17%, the low level of using management systems and management capacities services at the rate 9%, low Skills and expertise of implementing financial leadership at the rate of 21% low savings rate level of 16.6%, High-interest rate of 20%, and total assets decreased from 58% in 2010 to 42% in 2015, the population living below the poverty line to less than 30%; extreme poverty to less than 9%, Unemployment Rate of 13.2% and this could be fixed by the financial leadership management and control, however, it has no enough relationship on Financial Performance of Commercial Banks in Rwanda.

This is the reason the Researcher decided to carry out a study, which provided his contribution to the aforementioned gaps by
demonstrated the existence effect analysis of financial leadership and working capital of Commercial Banks in Rwanda.

I.2 Research Objectives
The general objective was to analyze the effect of financial leadership on the working capital of commercial Banks in Rwanda

I.2.2. Specific objectives
✓ To Analyze the contribution of Management efficiency on working capital of commercial Banks in Rwanda
✓ To assess the impact of management systems on working capital of commercial Banks in Rwanda
✓ To understand the effect of management capacities on working capital of commercial Banks in Rwanda

I.3 Research hypothesis
According to (Creswell J. , 2009) the Hypothesis is defined as a proposition that can be tested to determine its validity; it may prove to be correct or incorrect (positive or negative aspect). The function of the hypothesis is to test specifically the relationship between phenomena in such away. Referring to this assumption the researcher verified if really and to what extent the pillars of the Independent variable in this study (Life and Non-Life insurance services) have a significant role in the dependent variable in this study. The Hypothesis of this study was proposed based on Creswell’s confirmation

H₀₁: The Management efficiency has no significant contribution to the working capital of commercial Banks in Rwanda
H₀₂: The management systems have no significant impact on the working capital of commercial Banks in Rwanda
H₀₃: The management capacities have no significant effect on the working capital of commercial Banks in Rwanda

II. Diverse Literature Effect Analysis on financial leadership and working capital of commercial Banks in Rwanda
Different theories and models from Literature were used that assisted the conceptual relationship between financial leadership and working capital of commercial Banks, Rwanda as a case study.

II.1 Theoretical on the effect Analysis of the financial leadership and working capital of commercial Banks in Rwanda
During this study, Theoretical literature was based on thoughts and opinions of how Commercial Banks are in operations

II.1.1 The Leadership: Current Leadership: Current Theories, Research and Future Directions: Financial Sustainability for Nonprofit Organizations of (Bruce, Fred, & Todd, 2009)
According to (Bruce, Fred, & Todd, 2009) A great deal of leadership research has been undertaken over the years, which has led to a variety of financial leadership theories. The earliest studies on leadership started with the "great man theory," which stated that world progress results from individual achievements of great persons. This theory was questioned for its intentional sexism, linking financial leadership exclusively to individuals’ business.

Traits theories: the questioning of the great man theory led to the formulation of the leadership traits theories. Innumerable studies have been undertaken to examine physical, personal, social, and personality traits in individuals who are leaders; According to advocates of the leadership traits theories, these traits could determine whether an individual is a leader or not Gardner; Most studies conducted to show the consistency of the relationships between the traits associated with financial leadership and organizational effectiveness have failed to convince; Behavioral theories: The limitations identified in financial leadership traits theories led researchers to look at the behaviors of leaders. Research projects in behavioral theory have attempted to identify relationships between patterns of leadership behavior and the performance of groups within organizations.

The Contingency theories: the inability of behavioral leadership theories to take into account the situation where the process of influence is occurring facilitated the emergence of contingency theories, prompting researchers to turn to the context of leadership style. Fiedler 1967 studied the effectiveness of the leader based on the leadership style and the degree to which the situation or the context gives control and influence to the leader; Hersey and Blanchard in 1977 stated that the Financial leadership style is contingent on the situation, which means the level of followers’ readiness or maturity; The successful leader, according to Hersey and Blanchard, chooses the appropriate style for the particular situation.

In short, situational leadership theories promote the idea that the leader must understand his/her behavior, the behavior of the followers, and the situation before deciding to use any particular leadership style; Other approaches, such as the leader-member exchange theory, the path-goal theory House and the leader-participation model, have also considered the interaction between the process of leadership and the situation or the context; however, the contingency or situational theories of leadership have focused mainly on the relationships between the leader and the immediate followers and very little consideration has been given to the structure, politics, or symbols that constitute a leadership environment.

II.1.2 The Managerial Efficiency, Managerial Succession, and Organizational Performance theory, (John & Michael, 2010)
According to (John & Michael, 2010) the Managerial Efficiency, Managerial Succession, and Organizational Performance theory demonstrate how Managers perform several functions that are often deemed critical to the performance of organizations.

Thus, when organizations exhibit poor performance, there is a common notion that dismissing and replacing the manager will lead to improved performance. While that has intuitive appeal, both the assertion that 'performance causes succession and the counter-assertion that ‘succession causes performance' are subject to theoretical and empirical debate. Amid this controversy is the problem of measuring managerial performance. Managerial performance measures in business are often difficult to define, use
distorted or proprietary data, or are determined, in part, by forces outside managerial control. The researchers use data envelopment analysis (DEA) to introduce a new measure of managerial performance to this debate; DEA estimates the efficiency of a given manager relative to the efficiency of all managers in Managers perform several functions that are often deemed critical to the performance of organizations.

Thus, when organizations exhibit poor performance, there is a common notion that dismissing and replacing the manager should lead to improved performance. While that has intuitive appeal, both the assertion that ‘performance causes succession and the counter-assertion that ‘succession does not cause performance’ are subject to theoretical and empirical debate. Amid this controversy is the problem of measuring managerial performance. There are several reasons why basketball is a useful and convenient point of departure for our measure of managerial efficiency. First, data on inputs and output are readily available and provide easy-to-interpret proxies for the productivity relationships that exist in the industry. Second, the dimensions of basketball coaching parallel those of business managers.

The coaching function includes personnel decisions (recruiting, training, scheduling), the motivation of personnel (allocating playing time), and strategic planning (devising and altering offensive and defensive schemes). The Attribution and charismatic theories: Further research has contributed to more recent approaches to leadership, such as the attribution theory, which associates the performance of an organization to the leader by Pfeffer, 1992 and the charismatic theory in which the followers attribute the observed leader's behaviors to heroic or extraordinary leadership abilities.

II.1.3 The Systems Theory of Management in Modern Day Organizations - A Study of Aldgate Congress Resort Limited Port Harcourt (Chikere & Nwoka, 2015)

According to (Chikere & Nwoka, 2015) Organizational management systems consist of many internal subsystems that need to be continually aligned with each other. As companies grow, they develop more and more complex subsystems that must coordinate with each other in the process of transforming inputs to outputs.

In their own opinion, the above model requires expansion and development into a model of the processor operational management that indicates how the various inputs are formed through the managerial functions of planning, organizing, staffing, leading, and controlling. However, the following sub-topics are the basic components of a system.

i) Inputs: The composition of inputs from the external environment may include people, capital, managerial skills as well as technical knowledge of skills. It also includes the various claimant groups of people making demands on the organization; such as employees, consumers, suppliers, stockholders, federal, state, and local governments.

ii) Transformation process: In an organizational system, inputs are transformed into an effective and efficient manner into outputs. This can be viewed from different perspectives. Focus can be on such management functions as finance, production, personnel, and marketing.

iii) External variable As a component of the systems model, the external environment plays a key role in the transformation of inputs into outputs. While it is true that organizations have little or no power to change the external environment, they have no alternative but to respond to it.

iv) Outputs: Inputs are secured and utilized by transformation through the managerial functions with due consideration for external variables into outputs. Outputs of different kinds vary with the organization. They usually include many of the following: products, services, profits, satisfaction, and integration of the goals of various claimants to the organization.

v) Reenergizing the system, it is worthy of note that in the systems model of the management process, some of the outputs become inputs again. The satisfaction and new knowledge or skills of employees become important human inputs.

Similarly, profits are reinvested in cash and capital goods, such as machinery, equipment, buildings, and inventory. But tressing what Weirich et al had written, revealed that the systems theory has been likened by many management experts to the three-part production process of organizational activity. They revealed that Katz and Kahn in their analysis of the basic properties of an organization had also identified the input throughout the output process.

II.1.4 Contingency Theory of Capacity Planning: The Link between Process Types and Planning Methods (Antti, 2017)

According to (Antti, 2017), the theory of constraints was first proposed in 1986 by Goldratt. The theory of practical results of Goldratt’s work on ‘how to think’. TOC is a philosophy that suggests that any system must have at least one constraint otherwise it would generate an infinite amount of output and that constraints generally determine the pace of an organization’s ability to achieve its goal which is profit. Goldratt emphasizes that constraints pose a significant threat to the well-being of an organization and must be identified. The researcher suggests that constraints may be labor availability, staff skills, machine availability, and capital or time available. They may however be more difficult to identify such as organizational policies, guiding principles, or rate of innovation identified that there is rarely an equal flow of work within each work center in a process.

The constraint should therefore be the control of the pace of the process. This theory reduces the emphasis on maximizing all resources within the process and prioritizes the management of the bottleneck. The theory he advocates is called ‘drum, buffer, rope’ where the bottleneck is the ‘drum’ which marks the time through the process – due to insufficient capacity this should be working the most, the ‘buffer’ principle is required to make sure that the bottleneck is never short of work and therefore the front end of the process should stockpile inventory to maximize output.

When measuring capacity the unit of measure can be either an input or an output to the process. The key is to take the most
logical unit that reflects the ability of the operation to create its product or service. However, where the input is more complicated to measure, such as machine hours on a process layout, then output is a more suitable measure. The unit of time could be a minute, an hour, a day or a week, or whatever time scale fits the operation, but the unit of output and time scale needs to be consistent.

Input measures of capacity when using input measures of capacity, the measure selected is defined by the key input into the process. Where the provision of capacity is fixed, it is often easier to measure capacity by inputs, for example; rooms available in a hotel or seats at a conference venue. Input measures are most appropriate for small processes or where capacity is relatively fixed, or for highly customized or variable outputs such as complicated services.

The Output measures of capacity of the finished units from the process such as mobile phones produced in a day or cars manufactured per week. This measure is best used where there is low variety in the product mix or limited customization.

II.1.5 Toward A Theory Of Working Capital Management By (John S., 2020)

According to (John S., 2020)

The money manager is concerned with having funds available to meet current expenditures or for investment. As his receivables are collected, it is his responsibility to convert these checks into usable funds. An analysis of his banking methods might uncover methods of improving the inflow of his cash by presenting checks to the paying banks faster. Part of his cash frequently is in the form of both undeposited and uncollected checks. Accordingly, if he can deposit checks faster and thus reduce this amount of unavailable cash he can reduce his cash needs. Let me give you a concrete example of this. The corporates’ trucks as an example normally are delivered to the dealers on auto transports and in many cases, the dealer will pay the driver of the transport for the vehicles. In past years, the driver would carry the transport for the vehicles. In past years, the driver would carry the transport for the vehicles. In past years, the driver would carry the transport for the vehicles. In past years, the driver would carry the transport for the vehicles. In past years, the driver would carry the transport for the vehicles.

A business whose sales are relatively large compared to assets normally requires larger bank balances to support these sales than a business of similar asset size but with smaller sales. Generally the larger the sales, the larger is the amount of money tied up each day as undeposited funds in cash receipts.

Many corporations employ a rule-of-thumb and maintain cash balances at some multiple of average daily sales. Those companies subject to sudden cash drains often maintain additional cash balances for such occasions. Many companies maintain balances over and above these amounts as a means of compensating banks for services rendered. The determination of the size of the bank balances that a firm maintains cannot be considered a science—it is an imperfect art. It is an art, however, in which the money manager must appraise the value of his banking relationship and weigh it against the possible income that can be earned on balances above some minimum. In addition to determining the size of bank accounts, the money manager must decide where to maintain bank accounts. Here the approach is even more "artful."

A nationwide corporation needs depositories throughout the country, while a localized business may be well served by one or two banks. Banking relationships ordinarily are maintained in those territories or financial centers that enable the money manager to collect his receipts most promptly and facilitate the transfer of funds from area to area the area most easily. In recent years we have taken the soundness of banks for granted and have relied on governmental agencies to determine the safety factors behind deposits in various depository banks. Where a company's bank balance is above the insured amount, the money manager should evaluate the soundness of the bank for himself. In general, banks are very co-operative in supplying the information needed to determine the safety factors behind deposits.

II.2 The Econometric Model on the effect Analysis of Financial leadership and working capital of commercial Banks in Rwanda

The researchers’ empirical strategy was used to test the effect Analysis of Financial leadership and working capital of commercial Banks in Rwanda, uses the methodology of (Beck et al. 2004) to analyze the empirical relationship between Financial leadership and working capital of commercial Banks in Rwanda. Thus, the researchers’ regression equation of Economic growth is defined as follows:

\[
Y_{i,t} - Y_{i,t-1} = \alpha Y_{i,t-1} + \beta INS_{i,t} + \delta X_{i,t} + \delta X_{i,t} + n_t + e_{i,t} 
\]

(1)

where \((Y_{i,t} - Y_{i,t-1})\) is working capital of commercial Banks in Rwanda, \(X\) represents a vector of control variables (population growth, index of human capital, domestic investment, inflation, Cash Balance (CB)).

The researcher uses the following approximation to calculate the Liquidity Ratio (LR) between \(t\) and \(t-1\):

\[
\frac{Y_{i,t} - Y_{i,t-1}}{Y_{i,t}} = \frac{\Delta Y}{Y_{i,t}} \approx \ln CY_{i,t-1}
\]

According to the literature on Liquidity Ratio (LR) regressions to Solow, authors such as Beck et al. (2002) and Allen et al (2001), made an assumption of technical progress rate and a depreciation rate of the physical capital constants, the sum of which is \(p + d = 0.05\).

The government consumption, openness to commercial and terms of commercial), \(Y_{i,t-1}\) the logarithm of initial Liquidity Ratio (LR) to control the conditional convergence effect of the standard Solow-Swan growth theory and INS is financial Leadership penetration defined as ratio of premiums to Liquidity Ratio (LR) and Cash Balance (CB) \(n_t\) is the time fixed effects, \(e_{i,t}\) is the idiosyncratic error term and the subscripts \(i = 1, \ldots, N\), and \(t = 1, \ldots, T\), represent country and period, respectively. In equation (1), \(\beta\) is the researcher coefficient of interest and allows us to analyze the effect of financial leadership on the working capital of commercial banks. The researcher anticipates a positive sign for \(\beta\).

Furthermore, the convergence hypothesis between the financial studied suggests that the coefficient \(\alpha\) of \(Y_{i,t-1}\) is negative and significant in the growth model, ie \(0 < \alpha < 1\). To examine the heterogeneity of the effect analysis of financial
leadership on working capital of commercial Banks, the researcher specifies an augmented version of equation (1) as follows:

\[ Y_{i,t} - Y_{i,t-1} = \alpha' Y_{i,t-1} + \beta' INS_{i,t} + \rho \ast \left( INS_{i,t} \ast MS_{i,t} \right) + yMS_{i,t} + \theta' \ast \delta X_{i,t} + n' + e_{i,t} \]

Where \( MS_{i,t} \) represents the conditional variables of country-specific structural characteristics which are Management efficiency; management systems and management capacities and working capital composed by Liquidity Ratio (LR) and Cash Balance (CB); The three categories of conditional variables defined above include variables described as follows: first, to analyze whether Management efficiency has a positive contribution on working capital of commercial Banks in Rwanda; Second, to assess if management systems have a positive impact on working capital of commercial Banks in Rwanda; lastly Third, to understand if management capacities have a positive effect on working capital of commercial Banks in Rwanda.

The researcher retains the Management efficiency; management systems and management capacities and working capital composed by Liquidity Ratio (LR) and Cash Balance (CB), by himself but also through complementarities with Financial Sector in general, Commercial banks in particular.

II.3 Conceptual framework

A Conceptual framework is a diagrammatical research tool intended to assist the researcher to develop awareness and understanding of the situation under scrutiny and to communicate this (Kandampully & Tingting, 2019). In this case, the researcher finds out that the Financial statement analysis is the process of reviewing key financial documents to gain a better understanding of how Working Capital of the commercial banks are performing in terms of impacting the Balance Sheet, Income Statement, Cash Flow Statement and the Annual Report.

Normally the financial performance of Working Capital of commercial banks in Rwanda are characterized by different indicators such as Net Working Capital (NWC), Working Capital Requirements (WCR), Current Asset (CA) and finally Current Liability (CL) which all of these component can have academic challenges to analyse all of them based on the limitations on one side academic linkages between these pillars of Financial leadership and its indicators of Working capital of Commercial Banks and on other side time and finance. Based on that challenge, the researcher was focused on two active indicators only such as Current Asset (CA) and Current liability (CL).

A theoretical framework is used in research to outline possible courses of action or to present a preferred approach to an idea or thought. It can be defined as a set of broad ideas and principles taken from relevant fields of inquiry and used to structure a subsequent presentation. In this conceptual framework in figure 2.1, there are demonstrated the linkage between the independent variable and dependent variable as an outline
In figure 2.1, the conceptual framework gives an overview of the types of research variables that play roles in this study. In the above conceptual framework Management efficiency, Management systems and Management capacities are independent variables. The independent variables that are Financial leadership also referred to as manipulating variables deal with all theories and practices related to working capital of commercial banks; On the other hand, working capital is the dependent variable measured such as Current Asset and Current liability.

The use of appropriate framework Management efficiency in commercial banks gives them competitive advantage, reduces costs in most operations and services, and leads to efficiency in transactions and better customer services; These in turn lead to better Bank performance of commercial banks which adopt framework Management efficiency in their operations; On the other hand when commercial banks don’t adopt framework Management efficiency, they are likely not to realise competitive advantage, their costs should be high in most operations and services, maybe inefficient in their transactions and they should offer poor customer service which in turn lead poor Bank
II.4 Empirical analyses on financial leadership and working capital of commercial Banks in Rwanda

Different Knowledge and results derived from the investigation, observation, experimentation, and experiences were done by different researches on similar work with financial leadership with its pillars of Management efficiency (Investment Management and Operations management); Management systems (Information Management system and Online financial control), and Management capacities (Leadership capacity building management and Research and Development) working capital of commercial Banks (Current Assets (CA) and Current Liability (CL)) were dependent variables while Prudential regulations (Monetary Policy and Banking regulations) as intervening Valuable on opposed to the theoretical knowledge based on logical or mathematical assumptions to drive the study.

II.4.1 The contribution of Management efficiency on working capital of commercial Banks

According to (Abbadi & Abbadi, 2013) The contribution of Management efficiency examines the approaches of Working Capital of commercial Banks in a sample of Mauritian small and mid-sized manufacturing companies; The study was depending on the survey and case studies; A total of 145 forms were collected out of a sample of 420 manufacturing companies; The results indicate that the variables interpret 76.5% and 51.7% respectively in the variance of NOP in both sectors.

For (James, Benson, Robert, & Kibet, 2014) the contribution of Management efficiency on working capital of commercial Banks was demonstrated the mean short term debts from the year 2002 to 2011 depicts Kenya Commercial bank as the NSE listed bank with the highest mean of 99,160 million; This translate to the fact that KCB has the highest short term debts followed by Barclays bank with a mean of 97,474 million worth of short term debts. Equity bank ranks third with 89,954 million, Standard Chartered Bank ranks the fourth with 68,577 million while NIC bank has the least mean short term debts of Kshs 22,105M.

For (Sundararajan & Balino, 2011) the analysis for the debtors’ average collection period depicts that the National Bank of Kenya is the bank with the highest collection period of 382 days followed by Barclays Bank with 132 days. NIC has an average collection period of 126 whilst Cooperative Bank has an average of 110 days. Diamond Trust Bank had an average collection period of 107 days. Kenya Commercial Bank had 105 whilst equity averaged 87 days. CFC Stanbic had an average collection period of 79 days while Standard Chartered Bank 57 days. The industry or the market had an average collection period of 131 days.

As for (Muia, Banafa, & Mwanzia, 2017) The contribution of Management efficiency gave the average cash conversion cycle on working capital of commercial Banks and liquidity for 9 banks in ten year period between 2002 and 2011; National Bank of Kenya had the highest average cash conversion cycle of 371 days. Barclays bank had an average cash conversion cycle of 126 days whilst NIC bank had 111 days. Cooperative Bank and Kenya Commercial Bank had an average cash conversion cycle of 99 and 97 respectively. Diamond Trust Bank had an average of 91 days whilst Equity had 82 days. Standard Chartered bank had an average cash conversion cycle of 50 days. The market average conversion cycle was 122 days meaning that National bank and Barclays bank were above the Market level and their liquidity was at risk.

For (Marco, 2014) The contribution of Management efficiency with a mean value of firms return on assets is 28.69 percent of total assets, and it deviates 21.65 percent. It means that the value of profitability can deviate from mean to both sides by 28.69 percent. Its minimum value is 4.36 percent while the maximum is 93.26 percent. Likewise, the descriptive statistics for the two measures of the efficiency of working capital management, namely, average collection period, and leverage are also presented in the same table. Accounts receivable period, a measurement for collection policy, is averaged to 28.30 days for the sampled firms. The interpretation for the average of the account receivable period is that firms in the sample wait 28.30 days on average to collect cash from credit sales. The Account receivable period can vary by 11.27 days to both sides of the mean value.

As for (Huynh, 2011) The minimum and the maximum account receivable period for the sampled firms are 10.44 and 53.05 days respectively. There was a variation of 0.9% on the financial performance (ROA) of companies due to changes in the Average Collection Period and Leverage at a 95% confidence interval. This shows that 0.9% changes in the financial performance of companies could be accounted for by the Average Collection Period and Leverage.

The Management efficiency was assisted in the contribution of different business activities in Rwanda by 46,052,000Rwf representing a 29.9% increase. From 2010 to 2011 Akabanga sales have varied 21,334,000Rwf, representing 11.6% of the increase, and lastly, from 2010 to 2011, the commercial banks have gained
increased on working capital revenue from their financial activities of BK product which were of 18,912,000Rwf, representing 8.5%. From the percentage obtained, it is shown that from 2010 to 2017, Cogebank gained more income from the services compared to other years, (Sazir, Kato, & Twesige, 2019).

For (Twesige, Mwirumubi, & Mugerwa, 2016) The Management efficiency supported the capital conservation buffer increased on 2.5% of RWA and to be met with CET 1 capital, applies at all times and it is intended to ensure that institutions can absorb losses in stress periods lasting for many years. Considering the 4.5% CET 1 capital ratio, institutions must hold 7.0% CET 1 capital on an individual and consolidated basis at all times.

II.4.2 The impact of management systems on the working capital of commercial Banks by (Sundararajan & Balino, 2011)

According to (Sundararajan & Balino, 2011) The impact of management systems on working capital of commercial Banks was reduced by 75 percent and invoice reconciliation improved by 85 percent, which improved the company’s ability to leverage payment discounts; Working capital statistic of 2.02 reveals that the auto-correlation that was detected in the OLS regression result has been corrected; The result obtained shows that holding all the independent variables constant by 2.98 unit. Also, a unit increase in Net Profit Margin (NPM) holding other variables constant will increase working capital by 174 804.4 unit which confirmed that there is a positive relationship between working capital and unit profit margin.

For (Akoto, Vitor, & Angmor, (2013) this included the joint UNIDO and ISO project ‘Standard on Food Safety Management Systems in EAC countries’ which provided preparatory assistance for training of trainers and awareness courses on ISO 22000in five EAC Partner states. An additional 596 EAC regional standards have been developed since September 2007 bringing the current total to 1080 of which 187 are related to food, plant, or animal products.

As for (Christer, 2014) the Both spheres countries such as USA, UK, Brazil, France, Turkey, Singapore, Russia, China, Japan, Egypt, Nigeria, Cambodge, Mexico, Kenya, South Africa, Senegal, and others were demonstrated positive asset management acceptable by all efforts led to ISO on 55000 which consists of three standards; ISO 55000 provides critical overview Asset performance measures, concepts and terminology needed to develop a long-term plan that incorporates an organization’s mission, values, objectives, business policies and stakeholder requirements; ISO 55001 specifies the requirements for the establishment, implementation, maintenance and improvement of an asset management system.

For (Didier & Michael, 2014) Compared to corresponding benchmarks, seven categories of equity funds outperformed their benchmark while eight underperformed in some parts of Asian and European Countries. Equity funds with a focus of investment on Finland strongly outperformed their benchmark (5.3%) while equity funds with a focus of investment on Romania underperformed their benchmark (-5.3%); European focus of investment delivered 1%, respectively 0% on average in real terms, while monetary funds with a euro area focus of investment lost 1%. Real average annual performances for alternative investment funds ranged from 2% (for funds of funds) to 8% (for hedge funds).

(UNCTAD, 2018), the Asset performance measures by EAC Member states have also changed throughout the region’s financial performance commercial banks; Despite their dominant share in total exports, primary products fell in share from 53 percent in 2002–2004 to 44 percent in 2010–2012, on average, and were surpassed by manufactured products over time; Export markets also shifted more towards SSA and Developing Asia, replacing the past dominance of the European Union markets in EAC exports; the share of SSA in EAC exports increased from 30 percent in 2002–2004 to 36 percent in 2010–2012, while the share of developing Asia in EAC exports increased from 17 percent to 26 percent over the same period; The role of intra-EAC trade remains limited, accounting for only 19 percent of EAC exports in 2010–2012.

For (François, Oral, & Tomasz, 2014) EAC Member states like Rwanda followed by the United Republic of Tanzania and Uganda, and to a lesser extent Kenya, all had high Asset performance measures rates over the last decade affected the Financial performance of commercial banks, with Burundi being an exception due to its political and socio-economic crisis. Overall growth performance translated into sustained growth in real per capita GDP for all the countries except Burundi. In 2016, Kenya had GDP per capita of US$ 1455, the United Republic of Tanzania US$ 879, Rwanda US$ 703, Uganda US$ 615, and Burundi US$ 286. As a result, poverty fell significantly in general. However, inequality remained high across EAC partner states, implying that the benefits of growth were not equally distributed among individuals in society.

For (Mbanigaba, 2019) Commercial Banks in Rwanda such as ECOBANK, Bank of Kigali, I and M Bank generated diluted Asset performance measures of 0.28 U.S. Dollar cents, a fall of 83% compared with the 1.69 U.S. Dollar cents reported in 2014; Return on total shareholders’ equity (ROE) was 4.2% in 2015 versus 16.5% in the prior year; Profit attributable to shareholders of ETI amounted to $66 million, compared to $338 million in 2014; The major reason behind these less than satisfactory results was the high level of impairments on loans and financial assets made in 2015, totaling $532 million, almost double 2014’s level.

For instance, Rwandan Commercial banks reported revenues decreased by 8% in 2015, underlying revenues would have increased by 9%, assuming constant exchange rates. The cost base remained fairly stable, with a cost-to-income ratio (CIR) of 64.9%. The balance sheet is healthy, with a Tier 1 ratio of 20.5% and a total capital adequacy ratio (CAR) of 23.9%. The revenue for the year ended 31 December 2015 was $2.1 billion while that of the parent company was $174 million; Profit before tax for the Group was $205 million and $61 million for the parent company; The profit after tax stood at $107 million, (Mbonigaba, 2019).

II.4.3 The effect of management capacities on working capital of commercial Banks

According to (World Bank group, 2014) ranked the management capacities with the countries Commercial banks Life
expectancy by the support the working capital of commercial Banks; the Estimated GNI per capita based on the management capacities with Leadership capacity building management and Research and Development (2011 PPPS), Estimated GNI per capita (2011 PPPS), 2013 where Botswana ranked 7.9, Egypt, 2.8, S. Africa 41.1, Ghana 10.1, Congo 9.6, Kenya 19.9, Rwanda 51.9, Nigeria 6.6, Zimbabwe 35.1, Ethiopia 25.5, Tanzania 36.0 and Senegal 42.7. These were part of the classification that took these countries to the ascertain level of their capacity building and improved working capital of commercial banks based on the innovative rate aspect.

For the same scholar (World Bank group, 2014) the Countries in sub-Saharan Africa such as Ethiopia 173 and Rwanda 151 achieved the fastest growth management capacities, followed by Angola, Burundi, Mali, Mozambique, the United Republic of Tanzania, and Zambia. They all had the second-highest rate of progress in the capacity building and Human Development Index (HDI), which combined the achievements of their income in health and education that involved in the mainstream of the technical partnership strategy aspect.

Despite this mile, stone accomplishment mentioned by (Malik, 2014), shows that 585 million people in sub-Saharan Africa were trained with different skills and knowledge in Leadership capacity building management and Research and Development, the equivalent of 72 percent of the region's population, and were living in multidimensional poverty. This group of poor people also suffers deprivation in education, health, and living standards or at risk of falling back into poverty because of the low capacity building level mark, which is destruction to the sub-continents economic development.

In Sub-Saharan Africa, the Multi-Sectoral Regional Office in Nairobi and the Multi-Sectoral Regional Office in Yaoundé have had the highest regular budget on the management capacities with Leadership capacity building management and Research and Development expenditures in the period 2012-2017, that is US$ 51 810 and US$ 45 189 respectively. Over the three years, this has been less than the average US$ 10 000 per year supporting different physical activity which has been improving the production, (UNESCO, 2015).

(Egedy, Földi, Balogi, & Kovács, 2009) demonstrates that the returns to pieces of training for individuals were 13.1% in France and 6.1% in Sweden, whereas the estimated returns to the firm (productivity) for investments in training were 17.3% in France and 7.3% in Sweden. This was after investigating the effects of training and R&D on wages and productivity at the firm level in France and Sweden which improved the countries productions and also affected its Gross Domestic Product. The Same scholars (Egedy, Földi, Balogi, & Kovács, 2009), adds that French workers obtained 30% of the returns to training and Swedish workers about 35%; the firm, therefore, obtained the larger returns to investments in training, although the gains to workers are also substantial;

(Dearden, Reed, & Van, 2006) shows the impact of training on labor productivity in British industries between 1983 and 1996 on productivity and wages. An increase from the average of 10% to 11% in the proportion of workers trained in the industry, value-added per worker was about 0.6% and wages on 0.3%, which affected confidently their per capita and household income. The Human capital and indigenous innovation played a very important role in Portugal’s economic development from 1960 to 2001 were found that a 1% increase in average schooling led to a 0.42% was increased in productivity of different aspects. Also, a 1% increase in the internal stock of knowledge measured by the real accumulated expenditures on firms’ Research &Development depreciated at a rate of 5% per year, tended to increase productivity by 0.3%.

According to (Tom, 2008), USAID/Rwanda has worked in close the management capacities especially on Leadership capacity building and Research and Development with the Government of Rwanda (GOR) to advance the objectives outlined in its Vision 2020 and Economic Development and Poverty Reduction Strategies by improved its financial sector capacity; over the last 10 years, annual funding to USAID/Rwanda has increased from about $48 million in 2004 to over $128 million in 2016. The bulk of the increase was due to the launch of several new U.S. Presidential Initiatives including the President’s emergency plan for AIDS Relief (PEPFAR), the President’s Malaria Initiative (PMI), and the Feed the Future (FtF) food security initiative. USAID/Rwanda continues to support each of these Presidential Initiatives, as well as the Global Climate Change (GCC) initiative in its programming. For RDB Rwanda (2015), Different pieces of training include those that were supported by the department of Capacity Building Funds under the Rwanda Development Board and others by bilateral support the Beneficiaries of 8942 in 2010; 5557 in 2011; 7858 in 2012; 3385 in 2013; and 13167 in 2014.

The level of education in financial sector capacity building recorded a significant increase in the number of pupils, staff, and schools. The number of pupils increased from 159,291 in 2014 to 183,658 in 2015; that of staff increased from 4,671 in 2014 to 5,386 in 2015. While that of schools increased from 2,431 in 2014 to 2,618 in 2015. The Net Enrolment Rate increased from 13.3% in 2014 to 14.2% in 2015, while the Gross Enrolment Rate increased from 17.5% in 2014 to 20.2% in 2015 and thus achieving the 2014-2015 ESSP target, (Mineduc, 2014).

II.4.4 The importance of working capital on commercial Banks in Rwanda

According to (Mbanigaba, 2019) the proper management of working capital is essential to a company’s fundamental financial health and operational success as a commercial bank in Rwanda; A hallmark of good business management is the ability to utilize working capital management to maintain a solid balance between growth, profitability, and liquidity; A Bank uses working capital in its daily operations; working capital is the difference between a business’s current assets and current liabilities or debts; Working capital serves as a metric for how efficiently a company is operating and how financially stable it is in the short-term. The working capital ratio, which divides current assets by current liabilities, indicates whether a company has the adequate cash flow to cover short-term debts and expenses as some findings from Rwandan commercial Banks.
(Egedy, Földi, Balogi, & Kovács, 2009) assessed the magnitude of human capital spill-overs at the community level; his results were that 1 percent point increase in the supply of college graduates in an area raised the wages of high-school dropouts by 1.9%, of high-school graduates by 1.6%, and of college graduates by 0.4% which could affect the level and percentage of productivity of human capita; taking into consideration the countries’ in differing economic contexts, the results suggested that low-income countries benefited most from investments to expand primary education, with a full rate of return of 47% at this level; Middle-income country investments to expand secondary education carried by the highest overall returns at 52%. Besides, in high-income countries, expanding tertiary education yielded the best full returns at 20% of significance also was the finding that expanding higher education in low-income countries had relatively poor social returns that suggest that the capacity to utilize technology and add value to capital investments to keep improving the level of productivity, (Psacharopoulos & Patrinos, 2018).

III. Materials and Methodology

This study adopted a research philosophy from the empirical literature, hinged on two prominent research paradigms: positivistic and deductive philosophical approach. The positivist approach is quantitative and based upon values of reason, truth, and validity. The focus is purely on facts gathered through direct observation and experience and measured empirically using quantitative survey methods, experiments, and statistical analysis (Erickson & Kovalainen, 2008). Positivism maintains that knowledge should be based on real facts, not on abstractions.

III.1 Research Design

Proportional stratified sample size

<table>
<thead>
<tr>
<th>Targeted Banks</th>
<th>Target Population</th>
<th>Proportion (%)</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank of Kigali</td>
<td>95</td>
<td>11.46</td>
<td>31</td>
</tr>
<tr>
<td>Bank Populaire du Rwanda</td>
<td>94</td>
<td>11.34</td>
<td>30</td>
</tr>
<tr>
<td>I &amp;M Bank</td>
<td>85</td>
<td>10.25</td>
<td>28</td>
</tr>
<tr>
<td>Cogebanque</td>
<td>85</td>
<td>10.25</td>
<td>28</td>
</tr>
<tr>
<td>Ecobank</td>
<td>75</td>
<td>9.04</td>
<td>24</td>
</tr>
<tr>
<td>KCB</td>
<td>85</td>
<td>10.25</td>
<td>28</td>
</tr>
<tr>
<td>Equity</td>
<td>80</td>
<td>9.25</td>
<td>26</td>
</tr>
<tr>
<td>GT-Bank</td>
<td>85</td>
<td>10.25</td>
<td>28</td>
</tr>
<tr>
<td>Access Bank</td>
<td>75</td>
<td>9.04</td>
<td>24</td>
</tr>
<tr>
<td>Crane Bank (BCR)</td>
<td>70</td>
<td>8.44</td>
<td>23</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>829</strong></td>
<td><strong>100</strong></td>
<td><strong>270</strong></td>
</tr>
</tbody>
</table>

*Source: Secondary data, 2020*

The selected sample units show a general representation of other Commercial Banks Organs in the study area that operate in different business activities (sectors).

III.3 Sampling Frame

A research design is a plan or an overall strategy for conducting the research. It is a means of ensuring that a research process is systematic and scientific enough so that the results obtained can be applied in real life (Prabhat & Meenu M., 2015). This study was mainly descriptive research. Descriptive research studies are those studies, which are concerned with describing the characteristics of a particular individual or characteristic of a group, (Kothari, 2004).

For (Mugenda & Mugenda, 2003), on the other hand, define descriptive research as a process of collecting data to gain insight on the data patterns and answer questions concerning the status of the subject of study. (Sekaran, 2003), also contends that a descriptive study is undertaken to ascertain and be able to describe the characteristics of the variables of interest in a situation; A descriptive survey design was adopted for this study because; first, it was used to quantitatively describe specific aspects of the population. Finally, the study data used a sample of the population from Commercial Banks by utilizing questionnaires, from which research findings were generalized to the population.

III.2 Target population

The target population is an aggregation of study elements and refers to all members of a real or hypothetical set of people, events, or objects to which the researcher wishes to generalize the findings (Prabhat & Meenu M., 2015): The target population for the study was 829 from Bank of Kigali, Bank Populaire du Rwanda, I &M Bank, Cogebanque, Ecobank, KCB, Equity Bank, GT-Bank, Access Bank, and CraneBank (BCR) in financial activities operating from 2011 to 2019 which means that some of these Commercial Banks were started its performance activities in Rwanda in the aforementioned period with a sample size of 270 given after statistic calculation.

The sampling frame was designed to cover Commercial Banks officials such as DGs, CEOs, Directors, Head of Units, Specialists, Experts, Professionals from Rwanda. A study sample is a subgroup or a fraction of the target population and is a representation of the study population (Roger, 2011); Multistage sampling was used in this study; This was followed by systematic
random sampling, by using random number table digits to identify the respondent; The next step involved the selection of the respondents from the sampling frame of potential respondents from each targeted institution.

III.4 Sampling Technique
The sample size is the number of individuals from whom the researcher obtains the required information and is usually denoted by the letter \( n \). The respondents for this study were the Experts from Bank of Kigali, Bank Populaire du Rwanda, I &M Bank, Cogebanque, Ecobank, KCB, Equity, GT-Bank, Access Bank, and CraneBank (BCR). In determining the sample size, this study adopted the formula and procedure for categorical data using the Fishers formula; According to (Singh & Masuku, 2014) reformulated the formula of Yamane 1967, provided a simplified formula to calculate the said sample sizes as below.

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

Where \( n \) is the sample size, \( N \) is the population size, and \( e \) is the level of precision 5% for our study

Thus, \( n = \frac{N}{1 + N(0.05)^2} = \frac{270}{1 + 270(0.05)^2} = 269.7 \), and then, \( n = 270 \) employees.

For (Singh et al, 2014) added that the proportional stratified sample size means that, the number of sampling units drawn from each stratum is in the proportion to the relative population size of that stratum.

III.5 Data Collection Instruments
According to (Kothari, 2004) questionnaires are popularly used data collection tools. Primary data was collected using structured to have a broad range of data to enhance data accuracy.

III.5.1 Primary Data
Primary data was collected from 270 officials from different Commercial Banks such as Bank of Kigali, Bank Populaire du Rwanda, I &M Bank, Cogebanque, Ecobank, KCB, Equity, GT-Bank and Access Bank, and CraneBank (BCR) operating in Rwanda.

III.5.2 Secondary Data

III.6 Data collection procedures
According to (Creswell & Garrett, 2008), defined data collection is the process of gathering and measuring information on variables of interest in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes. For this study, primary data was collected by administering questionnaires face to face and via e-mail. 270 questionnaires were distributed to the different officials from the commercial Banks.

III.6.1 Validity Test of Research Instrument
Validity is about the accuracy of the data obtained in the study in representing the variables of the study (Saunders, 2015), defined validity as to how well an instrument measures what it is intended to measure. The study used open-ended and close-ended questionnaires with a Likert scale; Another important feature is the population for which the measure is intended, once some of these decisions were made and a measure was developed. This study established the validity of the research instrument with the help of the university supervisors and the pilot testing; In this study, the following measures were put in place to ensure the items in the questionnaire produced valid data.

The Expert opinion: the comments of supervisors were incorporated in the instruments as a way of improving their validity; a pretest study was carried out among the Director-General, Chief Executive Officer, Directors, Head of units, Experts, Specialists, and Professionals on the Effect Analysis of Financial Leadership on Working Capital of Commercial Banks in Rwanda, after which the results of the pilot data analysis were used to improve the validity of the instruments. Factor analysis: Validity test was also used on the research instrument using a method of Principal Component Analysis (PCA) to extract the factors.

The criteria, as suggested by (Chou, 2006), was those factor loadings greater than 0.40 were considered statistically significant for studies with a sample size less than 200. Consequently, in this study, 0.40 was used as the cut-off for loadings since the sample size of the study was 270. The higher the factor loadings were, the greater they were relating to the variable.

III.7 Data Analysis and Presentation

III.7.1. Data analysis
To support the relationships as suggested in the model, the study used statistical and econometrics Package for Social Sciences (SPSS version 21) to analyze the perception, multinomial model, and descriptive analysis. First, the researcher analyzed internal correlations to analyze the effect of the research variables. Second, the researcher conducted a standard multiple regression analysis to test for the direct effect of the independent variables on the working capital of commercial banks in Rwanda with its indicators such as Current Assets (CA) and Current Liabilities (CL).

III.7.2 Data Analysis and Presentation
The Data analysis was conducted according to the research objectives and hypotheses; This included the need to analyze the relationship between financial leadership and working capital of commercial banks based on different Institutions of Rwanda; Before processing the responses, data preparation was done on the completed questionnaires by editing, coding, entering, and cleaning the data and Data collected were analyzed using descriptive, econometrics, and inferential statistics.

III.8 Model specification
III. 8.1 Multiple Linear Regression Model
The study employed a multiple linear regression model given by the equation below:
\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \] without the moderator.

Where:

i. \( Y \): Working capital of commercial banks in Rwanda
ii. \( X_1 \): Management efficiency,
iii. \( X_2 \): Management systems
iv. \( X_3 \): Management capacities
v. \( Z \): Prudential regulations
vi. \( \beta_0 \): Coefficient of Intercept
vii. \( \beta_1 - \beta_3 \): The corresponding coefficients for the respective independent variables for financial leadership
viii. \( \varepsilon \): error term

The linear regression model is based on the following assumptions; the randomness of the error term, assumption of zero means of the error term, the assumption of constant variance, and assumption of normality of the variables. (Robert & Lachlan, 2014) emphasize that regression methods have become an integral component of any data analysis concerned with describing the relationship between a response variable and one or more explanatory variables; The data were obtained from the questionnaires that are primarily quantitative analyzed to identify the most statistically significant effect of the financial leadership (Management efficiency, Management systems, and Management capacities) with the variables of financial leadership and working capital of commercial banks in Rwanda.

III.9 Test of Hypotheses

According to (Creswell & Garrett, 2008) the ANOVA was used to determine whether there are significant differences between independent variable’s pillars of financial leadership such as (Management efficiency, Management systems, and Management capacities) on working capital of commercial banks in Rwanda at a selected probability level; The conclusion is based on the p-values where, if the null hypothesis is rejected then the overall model is significant and if null hypothesis fails to be rejected the overall model is insignificant. The null hypothesis with a p-value greater than 0.05 was rejected and the p-value less than 0.05 we failed to be rejected.

III.10 Statistical and econometric technique

Both econometrics and statistics allowed the researcher to analyze, present, and interpret data; the output was leading the researcher to show the effect analysis between financial leadership and working capital of commercial banks in Rwanda.

IV Data analysis and interpretation of the Effect analysis of Financial leadership and working capital of financial banks of Rwanda

IV.1 Response Rate

The survey was conducted in 2020 covering commercial banks in Rwanda. 270 structured questionnaires were distributed to the DGs, CEOs, Directors, Head of Units, Specialists, Experts, and Professionals. Out of the 270 questionnaires, 270 were filled and returned. This represented a 100% response rate. The response rate of 100% is therefore excellent. The recorded high response rate can be attributed to the data collection procedure, where the researcher obtained a research permit from the Ministry of Education of Rwanda, Directorate general of Science, Technology, and Research. Then, pre-notified the potential participants of the intended survey utilized a self-administered questionnaire where the respondents completed the questionnaires. The questionnaires were picked shortly after following up calls to clarify queries as well as prompt respondents to fill the questionnaires.

IV.2 Demographic information

This section presents the demographic characteristics such as gender, level of education, year worked in the organizations, organization size, and the number of years’ institutions and organizations that have been inexistent.
IV.2.1 Respondents Gender distribution

Source: Primary data, 2020
Figure 4. 1: Gender of the Respondents

In Figure 4. 1; out of 270 respondents who returned all the questionnaires distributed 41.48% were males and 58.52% were females. This implies that females were the majority of the researcher’s respondents who were implying that they are the majority heading the commercial banks in Rwanda.

IV.2.2 The Level of Education

Source: Primary data, 2020
Figure 4. 3: Level of Education

In Figure 4. 2; The Respondents’ qualifications varied greatly with a higher proportion of employees having university-level education at 83.3%, Post University at 16.7% which demonstrate that the respondents of the commercial banks were skilled with knowledge
IV.2.3 The Working Experiences in the commercial Banks

In Figure 4.3; The years worked distribution was that majority had worked for over 5 years 99.2%, while 0.8% of respondents worked with those commercials between 3 and 5 years as in Figure 4.3 the workforce is relatively high as some institutions and organizations have been newly established by the Rwandans.

IV.2.4 Type of Commercial Banks Institutions or Organizations

Table 4.1: Type of commercial banks

<table>
<thead>
<tr>
<th>Type of commercial banks</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accepting Deposits Commercial Bank</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>The lending of Funds Commercial Bank</td>
<td>2</td>
<td>0.8</td>
</tr>
<tr>
<td>Mixt Commercial Bank</td>
<td>268</td>
<td>99.2</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

In table 4.1 above, 99.2% of respondents were from the Mixt Commercial Bank, 0.8% were from The lending of Funds Commercial Bank and 0.0% were from Accepting Deposits Commercial Bank prospectively equal proportion.

IV.2.5 Life of institutions

Table 4.2: Life of institutions

<table>
<thead>
<tr>
<th>Life of institutions</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 to 10 years</td>
<td>4</td>
<td>1.5</td>
</tr>
<tr>
<td>11 to 15 years</td>
<td>265</td>
<td>98.1</td>
</tr>
<tr>
<td>Over 15 years</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The results from table 4.2 indicate that 98.1% of respondents indicated that their Commercial Banks have been in operation for years between 11 and 15 years, 1.5% between 6 to 10 years, 0.4% for over 15 years.
**IV.2.5 Commercial banks faced financial leadership component**

Table 4.3: Opinion on financial leadership component.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>295</td>
</tr>
<tr>
<td>No</td>
<td>05</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

The findings from Table 4.3 show that 97% of respondents said that their institutions faced the commercial bank face one of these three financial leadership components (Management efficiency, management systems, management capacities, and prudential regulations) towards the working capital of commercial banks.

**IV.3 The contribution of Management efficiency on working capital of commercial Banks in Rwanda.**

This section focuses on the results of the research on the relationship between financial leadership and financial performance.

**IV.3.1 The financial leadership supported by its pillar of Management efficiency with Investment Management and Operation management is improving positively the working capital of commercial banks in Rwanda.**

The Respondent’s perception of the financial leadership supported by its pillar of Management efficiency with Investment Management and Operations management is improving positively the working capital of commercial banks in Rwanda. Their responses were summarized in the table below.

Table 4.4: The financial leadership supported by its pillar of Management efficiency with Investment Management and Operation management

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>50</td>
</tr>
<tr>
<td>Agree</td>
<td>88</td>
</tr>
<tr>
<td>Disagree</td>
<td>130</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

The results from table 4.4 indicate that among 270 respondents, 48.1% of respondents disagreed the statement that the perception to the financial leadership supported by its pillars of Management efficiency with Investment Management and Operation management is improving positively the working capital of commercial banks in Rwanda, 32.6% agreed that the perception to financial leadership supported by its pillar of Management efficiency with Investment Management and Operation management is improving positively the working capital of commercial banks in Rwanda, 18.5 strongly agreed the perception to financial leadership supported by its pillar of Management efficiency with Investment Management and Operation management is improving positively the working capital of commercial banks in Rwanda and 0.7% strongly agreed the statement that financial leadership supported by its pillar of Management efficiency with Investment Management and Operation management is improving positively the working capital of commercial banks in Rwanda.

**IV.3.2 Investment Management as part of Management efficiency should improve the working capital of commercial banks in Rwanda**

The Respondent’s perception of Investment Management as part of Management efficiency should improve the working capital of commercial banks in Rwanda remain constant. Their responses were summarized in the table below.
Table 4.5: Investment Management as part of Management efficiency should improve the working capital of commercial banks in Rwanda

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>33</td>
<td>12.2</td>
</tr>
<tr>
<td>Agree</td>
<td>123</td>
<td>45.6</td>
</tr>
<tr>
<td>Disagree</td>
<td>114</td>
<td>42.2</td>
</tr>
<tr>
<td>Total</td>
<td>213</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

In Table 4.5. Shows that, among 270 respondents 45.6% agreed with the statement that Investment Management as part of Management efficiency should improve the working capital of commercial banks in Rwanda, 42.2% disagreed with the statement while 12.2% strongly agreed that Investment Management as part of Management efficiency should improve the working capital of commercial banks in Rwanda.

IV.3.3 The Management efficiency brought new strategies which assist in the achievement of commercial banks performance in Rwanda

This question brought was to check the perception of respondents to The Management efficiency brought new strategies which have stopped delay in payment of checks between banks; time wasted, fraud-related happen to the commercial Banks.

Table 4.6: The Management efficiency brought new strategies which assist in the achievement of commercial banks performance in Rwanda

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>19</td>
<td>7.0</td>
</tr>
<tr>
<td>Agree</td>
<td>141</td>
<td>52.2</td>
</tr>
<tr>
<td>Disagree</td>
<td>110</td>
<td>40.7</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Source: Primary data, 2020*

Among 270 respondents, 52.2% supported the statement that the Management efficiency brought new strategies which assist in the achievement of commercial banks performance in Rwanda, 40.7% disagreed with the statement while 7% strongly supported the statement The Management efficiency brought new strategies which assisting on the achievement of commercial banks performance in Rwanda.

IV.4 The The impact of management system on working capital of commercial Banks in Rwanda;

This section focuses on the results of the research on the relationship between the management system and the working capital of commercial Banks in Rwanda.

IV.4.1 The management system well oriented assisted by the improvement of Current Asset and Current liability as indicators of working capital of commercial banks

The respondent perception of the management system well oriented assisted by the improvement of Current Assets and Current liability as indicators of the working capital of commercial banks. Their responses are summarized in the table below.

Table 4.7: The management system well oriented assisted by the improvement of Current Asset and Current liability as indicators of working capital of commercial banks

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>6</td>
<td>2.2</td>
</tr>
<tr>
<td>Agree</td>
<td>253</td>
<td>93.7</td>
</tr>
</tbody>
</table>
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http://dx.doi.org/10.29322/IJSRP.10.11.2020.p107102

www.ijsrp.org

| Source: Primary data, 2020 |

In this table 4.7, Among 270 respondents, 93.7% of the respondents agreed with the statement that the management system well oriented assisted by the improvement of Current Asset and Current liability as indicators of working capital of commercial banks, 2.2% of the respondents strongly agreed, 3.3% disagreed on the statement that the management system well oriented assisted by the improvement of Current Asset and Current liability as indicators of working capital of commercial banks, and 0.7% strongly disagreed on the same statement that the management system well oriented assisted by the improvement of Current Asset and Current liability as indicators of working capital of commercial banks.

IV.4.2 The Responsibilities and duties require knowledge well oriented on management system supporting its component of Information Management system and Online Financial control projections are affecting the working capital of commercial banks in Rwanda

During the research, there was an assessment on The Responsibilities and duties requiring knowledge well oriented on management system supporting its component of Information Management system and Online Financial control projections are affecting the working capital of commercial banks in Rwanda:

| Table 4.8: The Responsibilities and duties require knowledge well oriented on management system supporting its component of Information Management system and Online Financial control projections are affecting the working capital of commercial banks in Rwanda |
| --- | --- |
| Frequency | Percent |
| Strongly agree | 41 | 15.2 |
| Agree | 188 | 69.6 |
| Disagree | 40 | 14.8 |
| Strongly disagree | 1 | 0.4 |
| Total | 270 | 100.0 |

Source: Primary data, 2020

The results from table 4.8 indicate that 69.6% of respondents agreed that the Responsibilities and duties require knowledge well oriented on management system supporting its component of Information Management system and Online Financial control projections are affecting the working capital of commercial banks in Rwanda, 15.2% strongly agreed that The Responsibilities and duties require knowledge well oriented on management system supporting its component of Information Management system and Online Financial control projections are affecting the working capital of commercial banks in Rwanda, 14.8% disagreed on the statement, 0.4% strongly disagreed that The Responsibilities and duties require knowledge well oriented on management system supporting its component of Information Management system and Online Financial control projections are affecting the working capital of commercial banks in Rwanda

IV.4.3 Strong management system plays a critical role in ensuring Banks stay financially adaptable and able to build resilience and sustainability in today’s fierce market.

During the research, there were assessments on Strong management system plays a critical role in ensuring Banks stay financially adaptable and able to build resilience and sustainability in today’s fierce market.

| Table 4.9: Strong management system plays a critical role in ensuring Banks stay financially adaptable and able to build resilience and sustainability in today’s fierce market. |
| --- | --- |
| Frequency | Percent |
| Strongly agree | 129 | 47.8 |
| Agree | 95 | 35.2 |
| Disagree | 46 | 17.0 |
The results from the table 4.11 indicate that 47.8% of respondents’ Strong management system plays a critical role in ensuring Banks stay financially adaptable and able to build resilience and sustainability in today’s fierce market, 35.2% agreed that Strong management system plays a critical role in ensuring Banks stay financially adaptable and able to build resilience and sustainability in today’s fierce market, while 17% disagreed with the statement that a Strong management system plays a critical role in ensuring Banks stay financially adaptable and able to build resilience and sustainability in today’s fierce market.

IV.5. The effect of management capacities on working capital of commercial Banks in Rwanda.
This section aims to establish the views of respondents on the effect between management capacities on working capital of commercial Banks in Rwanda. Table 4.10 shows the respondents’ perspectives on the strategy.

IV.5.1 The management capacities supported by Leadership capacity building management and Research and Development assist in the improvement of working capital with special skills and pieces of knowledge

Table 4.10: The management capacities supported by Leadership capacity building management and Research and Development assist in the improvement of working capital with special skills and knowledge

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>131</td>
<td>48.5</td>
</tr>
<tr>
<td>Agree</td>
<td>129</td>
<td>47.8</td>
</tr>
<tr>
<td>Disagree</td>
<td>8</td>
<td>3.0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The results from table 4.10, among 270 respondents, 48.5% strongly agreed supported the statement that the management capacities supported by Leadership capacity building management and Research and Development assist in the improvement of working capital with special skills and pieces of knowledge, 47.8% agreed that the management capacities supported by Leadership capacity building management and Research and Development assist in the improvement of working capital with special skills and pieces of knowledge, 3% disagreed and 0.7% strongly disagreed that the management capacities supported by Leadership capacity building management and Research and Development assist in the improvement of working capital with special skills and knowledge.

IV.5.2 Research and Development under development capacities are used to strengthen the efficiency of the working capital of commercial banks
The researcher tried to find out different sights of respondents on how the Research and Development under development capacities are used to strengthen the efficiency of the working capital of commercial banks.

Table 4.11: The Research and Development under development capacities are used to strengthen the efficiency of the working capital of commercial banks

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>144</td>
<td>53.3</td>
</tr>
<tr>
<td>Agree</td>
<td>106</td>
<td>39.3</td>
</tr>
<tr>
<td>Disagree</td>
<td>19</td>
<td>7.0</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

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From table 4.11 above, out of 270 respondents, 53.3% of respondents strongly agreed that The Research and Development under development capacities are used to strengthen the efficiency of the working capital of commercial banks, 39.3% of the respondents agreed that The Research and Development under development capacities are used to strengthen the efficiently of the working capital of commercial banks, 7% of respondents disagreed and only 0.7% of respondent strongly disagreed that the Research and Development under development capacities are used to strengthen the efficiently of the working capital of commercial banks.

IV.5.3 Leadership capacity of building management increases the capacity of the building of the commercial banks in Rwanda

The Respondents’ perception of Leadership capacity of building management increases the capacity of the building of the commercial banks in Rwanda. Their responses are summarized in the table below.

<table>
<thead>
<tr>
<th>Table 4.12: Leadership capacity of building management increases the capacity of the building of the commercial banks in Rwanda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>Agree</td>
</tr>
<tr>
<td>Disagree</td>
</tr>
<tr>
<td>Strongly disagree</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Source: Primary data, 2020**

In the table 4.12 above, 44.1% of the respondent strongly agreed on the concept that Leadership capacity of building management increases the capacity of the building of the commercial banks in Rwanda, 47.0% of the respondents agreed that Leadership capacity of building management increases the capacity of the building of the commercial banks in Rwanda, 7.4% of respondents disagreed on the concept while 1.5% strongly disagreed on the Leadership capacity of building management increases the capacity of the building of the commercial banks in Rwanda.

IV.7. The effect of Prudential regulations on the financial leadership and working capital of commercial banks in Rwanda.

This section focuses on the results of the research on moderating the effect of Prudential regulations on the financial leadership and working capital of commercial banks in Rwanda.

IV.7.1. The Prudential regulations well oriented is supporting the working capital of commercial banks

It is interesting to find out the perception of different respondents on the Prudential regulations well oriented in supporting the working capital of commercial banks.

<table>
<thead>
<tr>
<th>Table 4.13: The Prudential regulations well oriented supporting both financial leadership and working capital of commercial banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>Strongly agree</td>
</tr>
<tr>
<td>Agree</td>
</tr>
<tr>
<td>Disagree</td>
</tr>
<tr>
<td>Strongly disagree</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Source: Primary data, 2020**

The data presented in Table 4.18 above indicate that 50% of respondents agreed that The Prudential regulations well oriented are supporting the working capital of commercial banks, 40.4% strongly agreed on the same statement, 9.3% disagreed that the Prudential regulations well oriented are supporting the working capital of commercial banks while 0.4% of respondents strongly disagreed that The Prudential regulations well oriented are supporting the working capital of commercial banks.
IV.7.2. The strong Monetary Policy prescribed by the Central Bank regulates the management of working capital of commercial banks
The researcher was also interested in finding out how the strong Monetary Policy prescribed by the Central Bank regulates the management of the working capital of commercial banks. The findings were summarized in the table below.

Table 4.14: The Strong Monetary Policy prescribed by the Central Bank regulates the management of working capital of commercial banks

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>34</td>
<td>12.6</td>
</tr>
<tr>
<td>Agree</td>
<td>210</td>
<td>77.8</td>
</tr>
<tr>
<td>Disagree</td>
<td>25</td>
<td>9.3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

In the table 4.14, Among 270 respondents, 77.8% agreed that the strong Monetary Policy prescribed by the Central Bank regulates the management of working capital of commercial banks. 34 respondents or 12.6% strongly agreed to the concept that The strong Monetary Policy prescribed by the Central Bank regulates the management of working capital of commercial banks. 9.3% of respondents disagreed to the concept while 0.4% of respondents strongly disagreed the concept that The strong Monetary Policy prescribed by the Central Bank regulates the management of working capital of commercial banks.

IV.7.3 The Monetary regulation under the Prudential regulations should stay the main component assisting the working capital of commercial banks in Rwanda.
The Respondents gave their view on areas of the Monetary regulation under the Prudential regulations should stay the main component assisting in the regulation of the working capital of commercial banks in Rwanda.

Table 4.15: The Monetary regulation under the Prudential regulations should stay the main component assisting in the regulation of the working capital of commercial banks in Rwanda.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>37</td>
<td>13.7</td>
</tr>
<tr>
<td>Agree</td>
<td>208</td>
<td>77.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>24</td>
<td>8.9</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The results from table 4.15 indicate that 77% of respondents agreed with the statement that The Monetary regulation under the Prudential regulations should stay the main component assisting in the regulation of the working capital of commercial banks in Rwanda, 13.7% of respondents strongly agreed with the statement that The Monetary regulation under the Prudential regulations should stay the main component assisting in the regulation of the working capital of commercial banks in Rwanda, 8.9% of respondent disagreed the statement while 0.4% strongly disagreed the statement that The Monetary regulation under the Prudential regulations should stay the main component assisting in the regulation on working capital of commercial banks in Rwanda.

IV.7. The importance of the working capital on the performance of Commercial Banks in Rwanda
This section focuses on the results of the research in moderating the importance of the working capital on the performance of Commercial Banks in Rwanda

IV.7.1. The Prudential regulations well oriented is supporting the working capital of commercial banks
It is interesting to find out the perception of different respondents on The Prudential regulations well oriented in supporting the working capital of commercial banks.
Table 4.16: The Prudential regulations well oriented is supporting the working capital of commercial banks

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>109</td>
<td>40.4</td>
</tr>
<tr>
<td>Agree</td>
<td>135</td>
<td>50.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>25</td>
<td>9.3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The data presented in Table 4.16 above indicate that 50% of respondents agreed that the importance of the working capital on the performance of Commercial Banks in Rwanda, 40.4% strongly agreed with the same statement, 9.3% disagreed that the importance of the working capital on the performance of Commercial Banks in Rwanda while 0.4% of respondents strongly disagreed that the importance of the working capital on the performance of Commercial Banks in Rwanda.

IV.7.2. The Current Asset (CA) is a strong indicator of working capital in making the performance of commercial banks.

The researcher was also interested in finding out how The Current Asset (CA) is a strong indicator of working capital in making the performance of commercial banks. The findings were summarized in the table below.

Table 4.17: The Current Asset (CA) is a strong indicator of working capital in making the performance of commercial banks in Rwanda.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>34</td>
<td>12.6</td>
</tr>
<tr>
<td>Agree</td>
<td>210</td>
<td>77.8</td>
</tr>
<tr>
<td>Disagree</td>
<td>25</td>
<td>9.3</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

In the table 4.17, Among 270 respondents, 77.8% agreed that the Current Asset (CA) is a strong indicator in making the performance of commercial banks in Rwanda., 34 responds or 12.6 % strongly agreed to the concept that The Current Asset (CA) is a strong indicator of working capital in making the performance of commercial banks in Rwanda, 9.3% of respondents disagreed to the concept while 0.4% of respondents strongly disagreed with the concept that the Current Asset (CA) is a strong strong indicator of working capital in making the performance of commercial banks in Rwanda.

IV.7.3 The Current liability (CL) is a strong indicator of working capital as a strong indicator of working capital in making the performance of commercial banks in Rwanda.

The Respondents gave their view on areas of The Current liability (CL) is a strong indicator of working capital in making the performance of commercial banks in Rwanda.
Table 4.18: The Current liability (CL) is a strong indicator of working capital in making the performance of commercial banks in Rwanda.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly agree</td>
<td>37</td>
<td>13.7</td>
</tr>
<tr>
<td>Agree</td>
<td>208</td>
<td>77.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>24</td>
<td>8.9</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>270</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The results from table 4.20 indicate that 77% of respondents agreed with the statement that The Current liability (CL) is a strong indicator of working capital in making the performance of commercial banks in Rwanda. 13.7% of respondents strongly agreed with the statement that the Current liability (CL) is a strong indicator of working capital to achieve commercial banks performance while 0.4% strongly disagreed the statement that The Current liability (CL) is a strong indicator of working capital to achieve commercial banks performance.

IV. Inferential Statistics on effect analysis of Financial leadership and working capital of commercial banks in Rwanda

The researcher used this module to provide his contribution based on the findings and the module given in the Methodology.

4.8.1. Joint Model Summary: contribution of effect analysis of Financial leadership and working capital of commercial banks in Rwanda in terms of Current Asset (CA)

Regression analysis was used to establish the effect analysis of Financial leadership and working capital of commercial banks in Rwanda in terms of Current Asset (CA). Precisely, the following linear model was used:

\[ Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \epsilon \]

Where; \( Y \) stands for Current Asset (CA) while \( \beta_0 \) is the intercept (a constant), \( \beta_1, \beta_2, \beta_3 \) and \( \beta_4 \) are the slopes associated to the independent variables \( X_1, X_2, \) and \( X_3 \) ) and \( \epsilon \) is the error term which is assumed to be independent, identical and normally distributed random variable with a zero mean and a constant variance. In this study, \( X_1 \) denotes Management efficiency, \( X_2 \) denotes Management systems, and \( X_3 \) denotes and Management capacities. The findings were tabulated as shown in Table 4.21

Table 4.19: The effect analysis of Financial leadership and working capital of commercial banks in Rwanda in terms of Current Asset (CA)

<table>
<thead>
<tr>
<th>Dependent Variable: working capital of commercial banks in Rwanda in terms of Current Asset (CA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample: 270</td>
</tr>
<tr>
<td>Included Observations: 270</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I. Variable: WC</th>
<th>Coefficient</th>
<th>Std. coefficient</th>
<th>t-statistics</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Std. Error</td>
<td>0.731</td>
<td>0.311</td>
<td>2.583</td>
<td>0.000</td>
</tr>
<tr>
<td>Beta</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(Constat)</td>
<td>1.899</td>
<td>0.541</td>
<td>4.66</td>
<td>0.001</td>
</tr>
<tr>
<td>Management efficiency</td>
<td>0.052</td>
<td>0.041</td>
<td>4.66</td>
<td>0.001</td>
</tr>
</tbody>
</table>

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Table 4.19 displays the summary of the model used which assessed its best fit to the data and its coefficient estimates in an attempt to investigate the effect between financial leadership and working capital in terms of Current Asset (CA). From table 4.19, column 2, it is observed that $R^2$ which is the models’ goodness of fit for the regression line obtained is 0.718 which means that 71.8% of the variation in the dependent variable-Current Asset (CA) is being explained by the variation in the independent variable- financial leadership with only 28.2 % of the variation in the dependent variable being attributed to the error-term introduced in the theoretical model or other variables other than financial leadership explaining working capital of commercial banks.

$Y = \text{Current Asset (CA)} = 1.899 + 0.541X_1 + 0.633X_2 + 0.831X_3 + 0.002E$
Where Y as a Current Asset (CA), X₁ is Management efficiency, X₂ is Management systems, X₃ is Management capacities. From the above equation, it can be observed in column 2 that there is a positive unstandardized beta coefficient. From the above equation, it can be observed in column 2 that there is a positive unstandardized beta coefficient of 0.541 for X₁ (Management efficiency), 0.633 from X₂ (Management systems), and 0.831 for X₃ (Management capacities).

This indicates that a unit change in Management efficiency should increase in mean the working capital in terms of Returns on Assets of the Commercial Bank in Rwanda by 0.541 units from 1.899 when keeping Management systems and Management capacities constant; A unit change in Management systems should increase in mean the working capital in terms of Returns on Assets of the Commercial Bank in Rwanda by 0.633 units from 1.899 when keeping Management efficiency and Management capacities constant; Lastly A unit change in Management capacities should increase working capital in terms of Returns on Assets of the Commercial Bank in Rwanda by 0.831 units from 1.899 when keeping Management efficiency and Management systems constant.

However, the model indicates that Management capacities (β=0.831) contribute more, followed by Management systems (β=0.633) and lastly Management efficiency (β=0.541) respectively in contributing to the increase of the working capital of commercial banks in Rwanda. With a p-value of 0.002< 0.05. This indicates that the model used is the best fit for the data used, given all assumptions of normality underlying the model, in column 6, it can be concluded by said that financial leadership has a statistically effect analysis on working capital of commercial banks in Rwanda (F=3.991, R² = 0.718, Sig=0.002 at α=0.05).

Table 4.19 displays also the standard error of the estimate, which read, in column 5, 0.132 that is a measure of standard deviation around the fitted line. This measure suggests that about 95% of the prediction error in financial leadership is less than ±1.96 (0.132) = 1.26. It can be further observed that, from the current findings, this effect analysis can be extended to 0.01, or 99.99% confidence interval, since a p-value of 0.002 remains much less than 0.01 or a 1% as a level of effect.

Table 4-20: The effect analysis of financial leadership and working capital of Commercial banks in terms of Current liability (CL)

<table>
<thead>
<tr>
<th>Dependent Variable: Working capital of commercial Banks in Rwanda (Current liability (CL))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample: 270</td>
</tr>
<tr>
<td>Included Observations: 270</td>
</tr>
<tr>
<td>I. Variable: WC</td>
</tr>
<tr>
<td>Coefficient</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>1(Constant)</td>
</tr>
<tr>
<td>Management efficiency, X₁ is Management capacities</td>
</tr>
<tr>
<td>Management systems</td>
</tr>
<tr>
<td>Management capacities</td>
</tr>
<tr>
<td>R</td>
</tr>
<tr>
<td>R-squared</td>
</tr>
</tbody>
</table>
Adjusted R-squared 0.6421 Durbin-Watson statistics 1.776

F-statistics 5.264 Standard Error of Estimate 0.2416

Prob(F-statistic) 0.003

a. Predictors: (Constant), Management capacities, Management systems, and Management efficiency
b. Dependent Variable: Current liability (CL)

Table 4.20 displays the summary of the model used which assessed its best fit to the data and its coefficient estimates in an attempt to investigate the relationship between Financial leadership and working capital of commercial banks in terms of Current liability (CL). The correlation coefficient denoted in table 4.20, column 2 by R, between the variables under study, precisely between Financial leadership and working capital of commercial banks is 0.811. From a statistical point of view, since R=0.811 is quite close to 1, this finding suggests that there is a positive and indeed strong association between the variables studied. Same column 2, it is observed that R² which is the model goodness of fit for the regression line obtained is 0.811. This means that 81.1% of the variation in the independent variable- Current liability (CL) is being explained by the independent variable- financial leadership with only 18.9% of the variation in the dependent variable being attributed to the error-term introduced in the theoretical model or other variables other than current liabilities explaining working capital of commercial banks.

Concretely, this suggests that any input in terms of financial leadership would lead to more working capital of commercial Banks of Rwanda. From table 4.20, column 2, it is observed that the computed F statistic (2, 270) is 5.264 and in column 2, the p-value for the overall regression effect is (p = 0.003), which is less than 0.05 the level of significance. This indicates that the model used is a best-fit for the data used, given all assumptions of normality underlying the model; The Durbin-Watson statistic of 1.776< 2 which indicates that there is a positive serial of correlation among the observation; the same table illustrated that the regression equation deduced to understand this effect which was:

\[ Y_{Current \ liability \ (CL)} = 97.025 + 0.502X_1 + 0.755X_2 + 0.978X_3 \]

Where Yon Current liability (CL) illustrates the involvement of X₁ as Management efficiency, X₂ as Management systems, X₃ as Management capacities. From the above equation, this indicates that a unit change in Management efficiency should increase in mean the working capital in terms of Current liability (CL) of the Commercial Bank in Rwanda by 0.502 units from 97.025 when keeping Management systems and Management capacities constant; A unit change in Management systems should increase in mean the working capital in terms of Current liability (CL) of Commercial Bank in Rwanda by 0.755 units from 97.025 when keeping Management efficiency and Management capacities constant and finally a unit change in Management capacities should increase in mean the working capital in terms of Current liability (CL) of the Commercial Bank in Rwanda by 0.978 units from 97.025 when keeping Management efficiency and Management capacities constant.

However, the statistic model indicates that Management capacities (β=0.978) contribute more, followed by Management systems (β=0.755) and lastly Management efficiency (β=0.502) respectively in contributing to the working capital in terms of Current liability of Commercial Bank in Rwanda. With a p-value of 0.003< 0.05, this indicates that the model used is the best fit for the data used, given all assumption of normality underlying the model; in column 6, it can be concluded that financial leadership has an econometric and statistically effect on working capital of commercial banks.
commercial Bank (Management efficiency) in Rwanda ($F=5.264$, $R^2 = 0.811$, Sig=0.003 at $\alpha=0.05$). This measure suggests that about 95% of the prediction error in the working capital of commercial banks is less than $\pm 1.96$ (0.256) = 0.402. It can be further observed that, from the current findings, this significance can be extended to 0.01, or 99.99% confidence interval, since a p-value of 0.003 remains much less than 0.01 or a 1% as a level of effect.

V. Conclusion and Recommendations

V.1 Conclusion

From the findings, it was observed that the majority of respondents were from the Mixt Commercial Bank at 99.6%. The findings also revealed the majority of respondents being Female at 58.52%, the majority of 99.2%, have been in their positions for over 5 years. The highest level of education for the majority of respondents is a university degree with 83.3%, with each institution surveyed having a combined workforce was between 50 to 199 (78.2%); The study established many findings and they are summarized per objective.

The research findings demonstrate that Management capacities have a strong effect where the econometric and statistical analysis shows a strong effect on the working capital of commercial banks in Rwanda with ($\beta=0.831$) on Current Asset (CA), ($\beta=0.978$) on Current liability (CL). Based on these findings, the researcher approved the first hypothesis of this study with the assumption of $H_0$ and reject the second one of $H_0$; The same findings demonstrate that the Management systems play a positive effect on the working capital of Commercial banks in Rwanda. The econometric and statistical analysis shows the positive contribution of Financial leadership on the working capital of Commercial banks in Rwanda with ($\beta=0.827$) on Current Asset (CA) and ($\beta=0.755$) on Current liability (CL). The researcher approved the first hypothesis of this study with the assumption $H_0$ and rejected the second one $H_0$; The researcher findings demonstrate that the Management efficiency has a good effect on the working capital of commercial banks in Rwanda where the econometric and statistical analysis shows the ties contribution of Management efficiency with ($\beta=0.541$) on Current Asset (CA), ($\beta=0.502$) on Current liability (CL). The researcher approved the first hypothesis of this study with the assumption of $H_0$ and reject the second one of $H_0$.

V.2. Recommendation

The Researcher recommends that a Monitoring of Rwanda’s Financial leadership regularly should be taken into consideration to understanding trends, patterns in the Financial sector and provides an opportunity to highlight emerging issues on performance of commercial banks; This is of fundamental importance to achieve Rwanda’s Financial performance of commercial banks in Rwanda and eliminate the low level of using Financial leadership of working capital of commercial banks in the country.

The Researcher recommends that Central Bank’s Rules and Regulations on financial leadership digs should be more friendly and attractive to local and foreign investors’ Commercial Banks. This will mobilize their initiative in different businesses supported by commercial banks’ market directive and prices (equilibrium aspect) and encourage the community to be determined and oriented hence not sitting down and waiting for the community’ welfare support; overly, they will then pay the dues and taxes revenue.

The Researcher recommends that Rwandan Financial institutions and Civil Society, in general, keep the focus on the Country’ Visions by determining the specific targets to assist Rwanda to transform into a middle-income nation where Rwandans are healthier, educated, and generally more prosperous by involves the managing of capital investment towards a long-term program of proper management of Current Asset (CA) and Current liability (CL).

The Researcher recommends that the competition and consumption protection policy in its nature should promote equality by providing a fair business framework and with efficient and effective implementation in where economic operators are to get the same opportunities and chances to compete with each other.

The Rwandan Central Bank “BNR” should monitor and supervise Commercial Banks in Rwanda to ensure financial reporting, legal and regulatory requirements are met by the banks and transparent periodic reporting to stakeholders on Corporate Governance, Risk Management, and Internal Controls are undertaken.

REFERENCES

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SWOT Analysis and Strategy Planning At The Muhammadiyah AIMS And Charity Agency (Lazis Muhammadiyah) Of West Kalimantan, Indonesia

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Abstract- This research article aims to show the importance of a SWOT (Strength, Weaknesses, Opportunities, Threats) analysis for the Muhammadiyah Alms and Charity Agency (LAZIS Muhammadiyah) of West Kalimantan.

The research was carried out using a qualitative research paradigm. The research location in this study is at the the LAZIS Muhammadiyah of West Kalimantan. It is based on its location in the capital city of West Kalimantan Province and it has branches all over the West Kalimantan region. In this study, two types of data were collected, namely: primary data and secondary data.

The results of the study revealed that the SWOT analysis on the LAZIS Muhammadiyah of West Kalimantan shows that its strengths, among others: having legality in the form of the Decree of the Minister of Religious Affairs of the Republic of Indonesia, the Decree of the Regional Office of Religious Affairs of West Kalimantan Province and the Decree of the National Alms Agency of West Kalimantan Province. As for potential weaknesses, among others, are the lack of integrated IT, weakness in program planning; indicators of program success have not been established so that the final objectives of the program are not clearly defined. The opportunities include the large number of Muhammadiyah charities, many donors who have not been fully covered, the use of information technology developments in the socialization of zakat (alms). The threats include, among others, corruption which has plagued the economy, causing high costs, the environment and the availability of food and weak public awareness to give alms to charity management organizations. The strategic planning implemented by LAZIS Muhammadiyah of West Kalimantan includes value transformation, volunteer coaching and philanthropy.

Index Terms- LAZIS Muhammadiyah of West Kalimantan, Strength, Weaknesses, Opportunities, Threats, Strategy.

I. INTRODUCTION

Situation analysis is the beginning of the strategy formulation process. Situation analysis requires strategic managers to find strategic compatibility between external opportunities and internal strengths, as well as paying attention to external threats and internal weaknesses.

SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis is used to analyze the strengths and weaknesses that already exist, opportunities that arise and threats to the organization. External attributes refer to opportunities or threats, and internal attributes to strengths or weaknesses.

SWOT analysis is used to evaluate opportunities and challenges in the business environment and within the organization's internal environment. Top-level managers use SWOT analysis for self-reflection and group discussions about strategies to develop the organization and its position to achieve success.

Every organization faces challenges and changes due to globalization of politics, economy, information, technology and communication. The biggest challenge is the changes that affect the internal environment and the external environment of the organization. Organizational management in the traditional way does not consider changes, and adjustment to the environment will certainly be left behind. Modern organizational management takes into account the changes and challenges of the internal and external environment so as to be able to manage the organization effectively and efficiently. Therefore we need an analysis of the internal and the external environment to study the changes and challenges that affect the organization. SWOT analysis is one of the ways to conduct an environmental analysis.

Internal environmental analysis aims to obtain information about the strengths and weaknesses of the organization with regard to resources (personnel, systems / structures, equipment, finance), products / services, and customers / clients. For example, the large number of educated personnel who have the ability and managerial skills is the strength to run an organization effectively to achieve goals. A clear organizational structure with the duties, responsibilities of leaders and staff as well as adequate facilities and funding makes it easy for program management to achieve organizational goals. External environmental analysis aims to obtain information about opportunities and threats that affect the organization's journey in achieving its goals. It includes political, economic, social and technological factors related to the changes that will occur over the next 1-5 years. Some of the strategic questions that need to be answered are: What are the opportunities for developing the organization? What is the position of the organization in dealing with environmental changes? What innovations must be done to achieve success? Poverty results in unemployment and economic hardship resulting in very low purchasing power of the people to meet the needs for clothing, food, electricity and water. Decentralization policy provides an
opportunity for organizations to manage their own resources independent of the organization.

The initial agreement is basically an understanding among key decision makers or internal opinion makers about the strategic planning effort. The agreement must cover the benefits of strategic planning, the people, units, groups or organizations involved, the steps to be followed; establish and select the reporting time, planning, function and membership of strategic planning committee members and the commitment of resources needed to initiate the effort.

The zakat movement in an economic transformation is very important. The zakat movement is a movement to transform individual, material, capitalist, liberal economic life driven by greed, the pursuit of material and conflicting pleasures into a just economic life, guaranteeing growth, equal distribution, togetherness and welfare, ensuring the safety of resources, respecting human dignity and can prevent various conflicts in society. The concept of transformation implies that the zakat movement is a movement to educate humans, clean and nourish human life, a movement of awareness, enlightenment and community empowerment so that zakat can be accepted as a natural necessity of life and not something that is formally imposed.

The role of zakat in the economy is related to the nature of charity which is related to the assets of Muslims. Zakat in the economy can be likened to a mechanism for the redistribution of assets from muzakki to mustahik. As is well known, mustahik is a group entitled to receive zakat which includes eight groups, namely poor, poor, amil zakat (group or party collects zakat), new converts, slave servants, people in debt, activities in the path of Allah, and travelers who run out of provisions. The order of mustahik above shows that there is a priority for zakat distribution from a socio-economic perspective, with the poor being the groups that need to get the main priority for the distribution and utilization of zakat.

Organizations managing zakat in West Kalimantan, both agencies and organizations, include: LAZIS Muhammadiyah of West Kalimantan, National Alms Agency (BAZNAS) of West Kalimantan Province and West Kalimantan Ummat Wallet. LAZIS Muhammadiyah of West Kalimantan has branches in almost all regions of West Kalimantan.

Based on the explanation above, the aim of this study is to reveal the strengths, weaknesses, opportunities and threats as well as the strategic planning implemented by LAZIS Muhammadiyah of West Kalimantan.

II. RESEARCH METHOD

This research uses a qualitative paradigm with more emphasis on process, rather than results or product, process on meaning with the involvement of the researcher as the main instrument. Judging from the location of the data source, it is categorized as field research.

The data were collected from the Muhammadiyah Alms and Charity Agency (LAZIS Muhammadiyah) of West Kalimantan related to the SWOT analysis. The reasons for choosing the research location were based on 1) Located in the capital city of West Kalimantan Province; 2) has branches throughout West Kalimantan. The informants of this study were the management of the Lazis Muhammadiyah of West Kalimantan. Primary data were collected through interviews with Lazis Muhammadiyah of West Kalimantan management as informants, while secondary data were collected through literature and related documents.

III. THEORITICAL REVIEW

SWOT analysis can summarize a condition in a concise and clear way to help management understand the important issues in the organization when formulating its strategies. Among other things, influential strengths to use opportunities, and management must be alert to internal weaknesses, and external threats that must be overcome by management. SWOT analysis can also identify organizational competencies, namely the specific skills and resources the organization has and the superior means used with capabilities that strategically differentiate the organization, and the appropriate use of the organization's competencies will provide a sustainable competitive advantage.

Strengths are a resource or capacity controlled by an organization which makes the organization relatively superior to its competitors in meeting the needs of the customers it serves. Strengths arise from the resources and competencies available to the organization. Weaknesses occur when a limitation or deficiency in one or more resources or capacities of an organization against its competitors is an obstacle to meeting customer needs effectively. Limited financial capacity is one of the weaknesses that organizations have in choosing and developing strategies to increase revenues of a good organization.

Opportunities can occur when the main situation is favorable in the environment of an organization. The main trend is a source of opportunity. Identification of a market segment that was previously overlooked, changes in competitive or regulatory conditions, changes in technology and improved relationships with customers or partners can be opportunities for the organization. Threats occur when the main situation is unfavorable in the environment of an organization. Threats are a major barrier for organizations to achieve what they want. The entry of new competitors, slow market growth, increasing bargaining power of major buyers or suppliers, technological changes and their revisions or upgrades can be obstacles to the success of an organization.

SWOT analysis also has limitations in analyzing the business environment. The limitations of the SWOT analysis include: strength is not always an advantage, the SWOT analysis of the external environment is too narrow, the SWOT analysis provides analysis on static and non-dynamic situations and the SWOT analysis places too much emphasis on a one-dimensional strategy.

SO (Strengths - Opportunities) strategy uses the internal strengths of the organization to take advantage of external opportunities. Organizational management will like it when it is in a position where internal forces can take advantage of external trends and events. Organizations in general will carry out the WO (Weaknesses - Opportunities), ST (Strengths - Threats), or WT (Weaknesses - Threats) strategies so that it creates a condition where the organization can implement the SO strategy. When the organization has a major weakness, the organization will try to
overcome it and make it a Strengths. When the organization faces a major threat, the organization will try to avoid it to concentrate on opportunities.

The WO strategy aims to improve internal weaknesses by taking advantage of external opportunities. Sometimes there are external opportunities but the organization has internal weaknesses that prevent it from exploiting these opportunities. ST strategies use organizational strengths to avoid or reduce the influence of external threats. This does not mean that a strong organization must always face threats to its external environment directly.

The WT strategies are defensive tactics aimed at reducing internal weaknesses and avoiding external threats. An organization facing various external threats and internal weaknesses will be in an insecure position. In this position, the organization may have to try to survive, join forces, reduce size, or opt for liquidation.

Strategic planning is a management innovation that can last a long time, because it accepts and is built on the logical nature of decisions, raises and resolves important issues in its decisions. Strategic planning seeks to improve the form of decision making that highly considers organizational interests.

Strategic planning is very important, solving problems faced by organizations. Planners make preliminary agreements to anticipate important issues that arise through discussion where an effective coalition can come together. On the other hand, issues that are not well coordinated organizationally will make key decision makers avoid their responsibilities.

IV. DISCUSSION

a. Profile of Organization

The Muhammadiyah LAZIS of West Kalimantan has received a recommendation from the Muhammadiyah Regional Executive Board of West Kalimantan. Legally and formally LAZIS Muhammadiyah of West Kalimantan is under the LAZIS of Central Muhammadiyah which has been established by the Minister of Religious Affairs of the Republic of Indonesia under the Decree Number 457/2002 dated November 21, 2002 and has legality as the Central Alms Agency with the Decree of the Minister of Religious Affairs of the Republic of Indonesia number 730 of 2016 dated December 14 2016 concerning the granting of permission to LAZIS Muhammadiyah as a National scale amil zakat organization.

LAZIS Muhammadiyah of West Kalimantan’s VISION is “To be a trustworthy amil zakat (alms organization), infaq and shadaqah (charity organization),” LAZIS Muhammadiyah of West Kalimantan MISSIONS are (1) to optimize the quality of management of Zakat, Infaq, and Shadaqah which is trustworthy, professional, and transparent; (2) to optimize the use of Zakat, Infaq and Sadaqah which is creative, innovative, and trustworthy; (3) to optimize of donor services.

b. Discussion

The Strengths of LAZIS Muhammadiyah of West Kalimantan management is having legality, in the form of the Decree of the Minister of Religious Affairs of the Republic of Indonesia, the Decree from the Head of Regional Religious Ministry of West Kalimantan Province and from the National Zakat Management Board of West Kalimantan Province. LAZIS Muhammadiyah of West Kalimantan also has volunteers from both the Muhammadiyah Youths Association and the Muhammadiyah Teenagers Association. It also has representatives in almost all cities / districts in West Kalimantan. It is under direct instructions from the West Kalimantan Muhammadiyah Regional Executive Board. In addition, LAZIS Muhammadiyah of West Kalimantan has a Master Program (skilled community), which provides assistance and coaching as well as training, for example: sewing training, weaving training and training in agriculture as well as programs in the field of education, by providing scholarships for elementary - high school students (the poor). The scholarship program is also given to students, especially those who become cadres at Muhammadiyah called Sang Surya Scholarship. The mentoring program for new converts, especially for converts in Tebedak Village, Ngabang District, Landak Regency, West Kalimantan Province, has a strong commitment to always improving and independence in making decisions.

The potential weaknesses of LAZIS Muhammadiyah of West Kalimantan are among others they do not have integrated IT, weakness in the preparation of program plans; a program feasibility study has not been conducted; program success indicators have not been established so that the final objectives of the program are not clearly described. It also does not have an integrated system to measure organizational performance and progress on an ongoing basis; It has yet to have a clear strategy if they are logically linked, from medium to long term, so that the implemented programs are still scattered and not yet integrated, they are also unable to formulate the business process of raising funds from the zakat management institution, the institutional culture philosophy has not been formulated, management commitment to human resource development has not been optimal, feedback and coaching have not been carried out, a very wide range of control, which is limited by region and large number of people. Besides, LAZIS Muhammadiyah of West Kalimantan has limited capacity and capability, donor care, organizational communication and decision-making systems.

The opportunities for LAZIS Muhammadiyah of West Kalimantan are among others, the number of Muhammadiyah charity activities, many donors that have not been maximally covered, the use of information technology developments in the socialization of zakat, improvement of understanding and awareness of Islamic law which has an impact on awareness of paying Zakat, Infaq, Shadaqah and Waqf, community demands for transparency and public accountability for the management of public service programs both managed by the government and non-governmental organizations, opportunities for program cooperation and management of CSR funds with organizations, increasing public awareness of volunteer coaching activities, synergizing with the Government, State-owned Enterprises, NGOs, other OPZs to alleviate poverty. This shows the high commitment of LAZIS Muhammadiyah of West Kalimantan in empowering the mustahiq.

The threats to LAZIS Muhammadiyah of West Kalimantan are among others, corruption that has triggered a high cost economy, an increase in the open unemployment rate, especially youth unemployment (15-19 years), unpreparedness of MSMEs in the era of free trade, facing the entry of cheaper and quality imported products, empowerment programs and poverty
alleviation that has been carried out by government and non-government agencies which is still not in synergy, overlapping and lack of focus in defining programs resulting in resistance among beneficiaries, most of the Indonesian population that lives slightly above the poverty line and has a high vulnerability to re-enter the poor category, the deterioration of basic social services in Indonesia such as education, health, environment and food availability and weak public awareness to pay zakat to alms management organizations.

The main aspect that makes a muzakki willing to pay his zakat through a zakat management organization is trust. The OPZ cannot force the muzakki to pay zakat through its organization because zakat has not become an obligatory system under existing regulations. Lack of support from the government is also one of the threats to zakat managers. Government support is not sufficient by merely providing regulations, but it should also provide supervision. Zakat managers should be able to optimize the network to continue socializing and educating people on zakat in their respective regions. The socialization and education is carried out by prioritizing the basics of religious law concerning zakat. Zakat managers need to be more active in socializing and educating people on zakat because zakat management activities have received a legal umbrella in the state management system. After describing the strengths, weaknesses, opportunities and threats of LAZIS Muhammadiyah of West Kalimantan, the next step is to create a Strengths, weaknesses, opportunities and threats matrix (SWOT Matrix) which is an important matching tool to help managers develop 4 types of strategies: SO (strengths - opportunities), WO (weaknesses-opportunities), ST (strengths-threats) and WT (weaknesses-threats).

LAZIS Muhammadiyah of West Kalimantan in implementing SO (strengths-opportunities) uses strategies by developing household industry-based empowerment programs, developing volunteer management, developing advocacy institutions for the poor, strengthening public accountability in all programs & networks, optimizing technology for socializing zakat.

In implementing WO strategies (weaknesses-opportunities), LAZIS Muhammadiyah of West Kalimantan utilizes expert volunteers to strengthen institutional management, formulates and strengthens institutional culture, implements a performance measurement system that supports transparency and accountability of institutions by utilizing information technology, developing knowledge management and equitable development Human Resources.

Meanwhile, implementing the ST (strengths-threats) strategy is through means of public policy advocacy, strengthening and developing organizational branches. Implementing the WT strategy (weaknesses-threats) is done through selling unproductive assets and combining similar programs.

LAZIS Muhammadiyah of West Kalimantan also carries out strategic planning in its activities, namely value transformation, volunteer coaching and philanthropy.

A. Value Transformation

In planning a strategy for value transformation, LAZIS Muhammadiyah of West Kalimantan aspires to be a value spreading agency. The values that will be spread are caring, partisanship, fostering volunteering, independence and social entrepreneurship. LAZIS Muhammadiyah of West Kalimantan creates strategies to achieve goals, including (1) the conceptualization and description of values that will be transferred to the community, (2) the formation of an institution that is tasked with spreading the values of caring, partisanship, volunteerism, independence and social entrepreneur and (3) the values to be transferred have been transformed to the closest circle of LAZIS Muhammadiyah of West Kalimantan, such as: amil-amilat, partners and volunteers. The performance indicators used are, among others (1) the description of the values to be transferred has been agreed and approved, (2) a value-sharing institution has by definition been formed and has adequate human resources to develop the organization, and (3) all the ‘amilin-’amilat of LAZIS Muhammadiyah of West Kalimantan has fully understood the meaning and understanding of the values to be transferred.

LAZIS Muhammadiyah of West Kalimantan, can also implement a strategy to disseminate the values of its organization to all its branches and the values that have influenced the paradigm of all the main stakeholders and have materialized into widespread and wide impact. The performance indicator is that the value spreading agency has disseminated value to all its major stakeholders. To implement strategies to strengthen its image, LAZIS Muhammadiyah of West Kalimantan also makes innovations of conveying the values of its organization and has many cadres as value-spreading agents.

To implement strategies for value transformation, it develops concern, partisanship, volunteer coaching, independence and social entrepreneurship which has become the icon of this alms-giving organization. The performance indicators used are the values of care, partisanship, volunteer coaching, independence and social entrepreneurship, which are synonymous with its organizational image. In addition, LAZIS Muhammadiyah of West Kalimantan implements strategies for its established value spreading organization which has been recognized and has become a reference for the development of values such as caring, partisanship, volunteer coaching, independence and social entrepreneurs. The indicators used are among others this value spreading agency has been able to finance its operational activities.

B. Development of volunteers

In implementing strategies for training volunteers, LAZIS Muhammadiyah of West Kalimantan carries out the aim of forming a civil society cluster. This is implemented in community reform programs, community volunteering and community activity centers

1. Reform Community

Reform Community has unique significance, integrated efforts, Islamic values, with supporting infrastructure including religion, economy, social and culture, value transformation, creating new locations or supporting existing communities, the mustahiq having their business business assets) and can be used as a social tourit attraction as well as a strategic location and can be monitored. LAZIS Muhammadiyah of West Kalimantan can implement strategies by, among others; (1) formulating the concept of reform community which includes meaning, structure and infrastructure that is representative of the Value Transformation plan, value distribution agents, volunteer

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laboratories and social tourism spots. (2) A prospective area has been selected to become the Reform Community which consists of the Community of LAZIS Muhammadiyah partners in West Kalimantan or a new area in accordance with the concept of the LAZIS Muhammadiyah Reform Community (3) religious, social and economic values that are unique to the community components of the Reform Community have been established.

LAZIS Muhammadiyah of West Kalimantan can also implement a strategy through (1) the principles of caring, partisanship, volunteer coaching, independence and social entrepreneurship. (2) All economic activities carried out in the Reform Community have implemented the “Quality Management System” standard. (3) There has been synergy between members of the Reform Community and local residents. (4) The concept of social tourism has been structured in a bottom-up manner by involving the members of the Reform Community. The indicators of success include (1) there has been economic activity characterized by expert management, operational income that has been obtained, and reflection of the synergy between communities in the Reform Community itself and with parties outside the Reform Community. (2) It has a social tourism concept that is initiated in a participatory manner by the community. (3) The values of caring, partisanship, volunteer coaching, independence and social entrepreneurs that have been socialized in the midst of the Reform Community. LAZIS Muhammadiyah of West Kalimantan can also implement strategies in a way that the Reform Community has understood and is aware of developing and disseminating values; the Reform Community has the confidence and ability to develop themselves and their communities, and has inspired business partners or the surrounding community to apply the transferred values. The indicators of success are the values of care, partisanship, coaching of volunteers, independence and social entrepreneurship which have been implemented in the midst of the community.

LAZIS Muhammadiyah of West Kalimantan can also implement strategies with targets including (a) economic improvement or an increase in the standard of living of the Reform Community. (b) The Characteristics of a Reform Community as KlasTer (Enlightened Classes) which have begun to appear more than just symbols. (c) The community and its environment are ready as a social tourism destination. (d) Value Transformation agents are formed. The indicators of the success of the performance are (a) the standard of living of the community in the reform community program has increased by 30 percent better than before. (b) Five Reform Communities that implement the concept of social tourism are ready to receive intensive visits from the wider community. (c) There have been at least 5 Value Transformation cadres in each Reform Community. LAZIS Muhammadiyah of West Kalimantan also implements strategies with the objectives to be implemented including (1) formation of Enlightened Classes with the following characteristics: independent, attracting socio-economic, religious and cultural activities. (2) Being a social tourism spot. (3) having multiplier effects in terms of socio-economy, religion, etc. to the surrounding community.

2. Volunteer Community
Volunteer community implies that it is a community that cares, has expertise, has concern and non-profit orientation, and is actively involved in the programs of LAZIS Muhammadiyah of West Kalimantan. LAZIS Muhammadiyah can implement strategies with the following targets: (1) The concept of LAZIS Muhammadiyah of West Kalimantan Volunteer Community has compiled a complete set of both general guidelines and technical implementation guidelines and is ready to be implemented. (2) All branches in the regions have functioned as a medium for the growth and development of local volunteers. The performance indicators of success used as a reference are (1) At least one activity has actively involved volunteers. (2) The concept of Volunteer Community has been socialized to all branches of LAZIS Muhammadiyah of West Kalimantan.

LAZIS Muhammadiyah of West Kalimantan can also implement the following strategies to turn volunteers into value transformation agents in an established circle and have involved expert volunteers in the activities of its branches. It can also implement strategies with the following targets: the optimization of the volunteer community by forming a forum that can answer the needs of volunteers and the activities and productivity of the activities of the volunteers. LAZIS Muhammadiyah of West Kalimantan has started to be directed to address global issues. The performance indicators of success that serve as guidelines are the formation of a forum for volunteers who are able to synergize various existing communities and the volunteers that have carried out advocacy activities on global issues that are detrimental to society.

LAZIS Muhammadiyah of West Kalimantan can also apply strategies with targets as follows: the existence of its volunteers has been recognized among established circles and there are volunteer communities in the branches. It also has goals to be realized, namely to form communities of volunteers who have high loyalty and the community of its volunteers that can inspire the activities of other volunteers in Indonesia.

3. Community Activity Center
Community Activity Center implies a physical establishment and the activity center of the LAZIS Muhammadiyah of West Kalimantan. Strategies with the following targets can be applied: the formation of concepts and activity programs as the center of community activities and a location that will be used as a center for community activities. The indicators of success in performance are among others, the center of community activities has been defined definitively and the ownership has become the property of LAZIS Muhammadiyah of West Kalimantan and the process of building facilities and infrastructure has begun.

LAZIS Muhammadiyah of West Kalimantan has a target that the Community Activity Center becomes a place for all programs of the organization, and is widely recognized as the center of activities of the organization. The indicators of success are among others, all activities of the organization have been centered in the Community Activity Center. Another target to be achieved is that the Community Activity Center becomes a reference for community development and the image of the community activity center becomes the top-of-mind awareness.

This alms giving agency also has other targets to be achieved, namely its activities are centered in its center and the center can make a positive contribution to the development of the surrounding community. The indicator of success in its
performance is that the socio-economic activities around the location of the community activity center are more active and continue to grow. LAZIS Muhammadiyah of West Kalimantan also aims to have a permanent community activity center as a community development laboratory. The indicator of success in its performance is that the activities are concentrated in a permanent location.

C. Philanthropy

In implementing strategic planning for Philanthropy, LAZIS Muhammadiyah of West Kalimantan aims to become the best Islamic Philanthropic organization. The targets to be achieved are measuring the effectiveness of institutional performance, achieving the capacity of working partners, improving the quality of Human Resources, encouraging alternative organizations in the field of muamalah and towards Islamic Philanthropic Organizations.

V. CONCLUSION

Based on the explanations above, the following conclusions can be drawn:

1. The strengths of LAZIS Muhammadiyah of West Kalimantan, among others: having legality, in the form of the Decree of the Minister of Religious Affairs of the Republic of Indonesia, the Decree from the Head of Regional Religious Ministry of West Kalimantan Province and from the National Zakat Management Board of West Kalimantan Province. LAZIS Muhammadiyah of West Kalimantan also has volunteers from both the Muhammadiyah Youths Association and the Muhammadiyah Teenagers Association. It also has representatives in almost all cities / districts in West Kalimantan.

2. The potential weaknesses of LAZIS Muhammadiyah of West Kalimantan are among others they do not have integrated IT, weakness in the preparation of program plans; a program feasibility study has not been conducted; program success indicators have not been established so that the final objectives of the program are not clearly described. It also does not have an integrated system to measure organizational performance and progress on an ongoing basis; It has yet to have a clear strategy if they are logically linked, from medium to long term, so that the implemented programs are still scattered and not yet integrated, they are also unable to formulate the business process of raising funds from the zakat management institution, the institutional culture philosophy has not been formulated.

3. The opportunities for LAZIS Muhammadiyah of West Kalimantan are among others, the number of Muhammadiyah charity activities, many donors that have not been maximally covered, the use of information technology developments in the socialization of zakat, improvement of understanding and awareness of Islamic law which has an impact on awareness of paying Zakat, Infaq, Shadaqah and Waqf, community demands for transparency and public accountability for the management of public service programs both managed by the government and non-governmental organizations.

4. The threats to LAZIS Muhammadiyah of West Kalimantan are among others, corruption that has triggered a high cost economy, an increase in the open unemployment rate, especially youth unemployment (15-19 years), unpreparedness of MSMEs in the era of free trade, facing the entry of cheaper and quality imported products, empowerment programs and poverty alleviation that has been carried out by government and non-government agencies which is still not in synergy, overlapping and lack of focus in defining programs resulting in resistance among beneficiaries, most of the Indonesian population that lives slightly above the poverty line and has a high vulnerability to re-enter the poor category, the deterioration of basic social services in Indonesia such as education, health, environment and food availability and weak public awareness to pay zakat to alms management organizations.

5. Strategic planning implemented by LAZIS Muhammadiyah of West Kalimantan includes value transformation, volunteer coaching and philanthropy.

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Determinants of Project Scope and Project Performance: A Case of Huguka Dukore Akazi Kanoze Project

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Abstract: The main objective of this study was to analyze the effect determinants of project scope on project performance. This study adopted survey research design using both quantitative and qualitative methods. The target population of this study was employees and beneficiaries of Huguka Dukore Akazi Kanoze project. This study used 75 respondents, for choosing 75 respondents simple purposive sampling technique was used. Finally, the data collection methods were included research questionnaires, and documentation Therefore, the findings were shown that 60.0% of respondents and 40.0% of respondents strongly agreed and agreed respectively that the first kind of resources in Huguka Dukore Akazi Kanoze is natural or physical resources, again 60.0% of respondents strongly agreed that the second kind of resources in Huguka Dukore Akazi Kanoze is financial resources finally 60.0% of respondents agreed that other kind of resources in Huguka Dukore Akazi Kanoze is human resources. The findings revealed that 80.0% of respondents agreed that in the performance of Huguka Dukore Akazi Kanoze project is indicated by High productivity or outcome of the project, 80.0% of respondents agreed that in Huguka Dukore Akazi Kanoze project is indicated by meeting the needs of stakeholders (stakeholders satisfaction), 66.7% of respondents agreed that in Huguka Dukore Akazi Kanoze project is indicated by cost performance and quality finally 77.3% of respondents agreed that in Huguka Dukore Akazi Kanoze project is indicated by Meeting deadline. In general, the research findings revealed out that there is significant relationship between determinants of project scope and project performance. Basing on the conclusion made, the researcher recommended that the project has to involve beneficiaries in the definition of project scope would help to understand more their expectation to avoid changing the scope based on this condition and beneficiaries have to ensure their participation to be able to kwon if the project is taking the right direction to satisfy their needs.

Key words: Determinants of project scope, project performance, Project, Project scope, Huguka Dukore Akazi Kanoze Project

1. Introduction

This chapter presents the background of the study, statement of the problem, objectives of the study, research questions, and scope of the study, significance and limitations that the researcher encountered during the research exercise. Scope describes the boundaries of the project in terms of what it was deliver. It defines all project work thus ensuring thus help project team set up control systems that could bring a better project outcome (PM4DEV, 2008). Further scope management are processes required to ensure the project includes all the work and only the work that is required to complete the project successfully, deliverables include: scope statement; work breakdown structure and formal acceptance (Horine, 2013).

Al Humaidan, (2011) attributed project failure to inadequate pre–project planning and poor project definition of project elements. 70% of poor time performance of Saudi Arabia construction projects is due to changes in project scope (Assaf and Al–Hejji, 2006). Further lengthy project delays Saudi Arabia are caused by a number of issues such as unqualified contractors, changes in scope of work, rework in inappropriate parties involved in procurement methods.

Like elsewhere in the world, Africa projects are often not completed in time and experience inadequate scope definition and cost overruns, their failure late is in excess of 50%; World Bank private firm IFC (International Finance Corporation) has half of its
projects succeed while half fail (Associated Press, 2007). Rwelamila and Puurushottam, (2012) claimed that project management competency may be improved for better project outcome; they also attributed lack of quality training in project management as a major drawback to Africa development. The performance of a project depends on controlling and managing the scope. Changes in scope can impact the cost, schedule, risk and even the quality of the project. The beneficiaries, the project sponsor or other stakeholders can initiate scope changes. A scope change request is used to request an addition or subtraction to the agreed upon scope of work agreed upon for a project. Scope change requests may be managed as part of a pre-defined scope change process outlined as part of the project plan. This process would determine what changes may be approved by the project team and the procedure as well as authority for approving other changes. The key to successful scope management is defining, communicating and reconciling emerging requests throughout the project lifecycle. When a project's scope changes mid-course it will typically mean added costs, resources, time, extended duration and greater risks. Sometimes it is a number of small scope changes that impact the successful completion of a project rather than one large scope change. Without change control, the project scope becomes a moving target and the project at risk of missing one or more of project success factors. Project change is inevitable and you must be prepared to deal with it when it happens (Suchan, 2007). As business needs change, organizations developed in line with these changes especially in the present age of increased awareness and need. Organizations that maximize the use of new technologies found themselves dealing with schemes that are difficult and expensive to implement (Ojiako et al., 2015).

Several organizations face challenges in implementing their plans to desire expectations and these challenges do stem from improper gathering, interpretation and documentation of requirements and defining the boundary (scope) needed to fulfill project objectives. In Rwanda many projects among agriculture projects specifically, are failing to meet business expectations and user needs due to factors such as poorly defined scope, cost and time overruns, inadequate quality and meeting up with expected features and functions to satisfy project stakeholders. UNDP report 2016 revealed that 39% of all projects implemented in 2014 were successful (delivered to time on budget and with required features and functions), 43% were challenged (late, over budget with unsatisfactory required features and functions) and 18% failed (cancelled prior completion or delivered and never used). However, an increase in project quality was observed over the years and this was as a result of several factors such as methods, skills, costs, tools (Ojiako et al., 2015). Decisions, internal and external influences, team bonding, technology and paramount amongst these are the increased awareness and introduction of project management especially in the various stages of project implementation including project scope management practices needed for projects performance. The general objective of this study is to analyze the impact of determinants of project scope on project performance at Huguka Dukore Akazi Kanoze project.

The specific objectives of the study are:

i. To find out how available resources affect productivity of Huguka Dukore Akazi Kanoze project;

ii. To analyze the effect schedule on meeting the needs of stakeholders of Huguka Dukore Akazi Kanoze project.

iii. To analyze the influence of budget on the performance in Huguka Dukore Akazi Kanoze project

iv. To analyze the relationship between determinants of project scope and project performance in Huguka Dukore Akazi Kanoze project.

2. LITERATURE REVIEW

The part concerns the explanations about existing theories in relation with the topic. Here, the researcher tried to explain theories related to determinants of project scope and project performance.

2.1 Concepts of project
Key concepts clarified in this work are: project, project scope, project performance. A project is an activity to meet the creation of a unique product or service and thus activities that are undertaken to accomplish routine activities cannot be considered projects. For instance, if your project is less than three months old and has fewer than 20 people working on it, you may not be working in what is called a project according to the definition of the term (Shannon, 2011).

According to Linda (2017), a project in any organization is collaboration across departments to achieve a single well defined objective. The process of planning, organizing and managing resources to achieve the organizational objective is called project management.

2.1.2 Project scope

According to Mesly (2017), Project scope is the part of project planning that involves determining and documenting a list of specific project goals, deliverables, features, functions, tasks, deadlines, and ultimately costs. In other words, it is what needs to be achieved and the work that must be done to deliver a project.

2.1.3 Project performance

Project performance can be measured before during and after project completion. In simple terms, project success can be defined as: achieving project objectives within schedule and within budget, to satisfy the stakeholder and learn from experience (Thomas, 2009).

2.1.4 The determinants of project scope

Scope describes the boundaries of the project in terms of what it will or will not deliver. It defines all project work thus ensuring thus help project team set up control systems that could bring a better project performance (Puurushottam, 2012).

Further project scope is process required to ensure the project includes all the work and only the work that is required to complete the project performance, determinants include: competitive advantage, organizational process assets, expert judgment, complex activity list, limited resources, fast-tracking, project delays, client’s demand, technical skill required, dynamism of technology, returns on investment. For this study, project scope is determined by the following: Available resources, time/schedule, budget and cost

2.2 Empirical literature

The study done by Ahsan and Gunawan (2010) about analysis of cost and scope performance of international development projects focuses on cost and scope issues of international development projects. The study examines project cost and schedule performance and the main reasons for poor project outcome. Every project must have a picture of the product or service it will deliver to its beneficiaries. The findings of this research indicate that the project scope affects the project product positively. In this line, 43% of respondents said that scope helps to achieve its desired outcome, 70% accredited the fact of meeting the need of beneficiaries and 72% talked about the satisfaction of quality expectations.

The study done by Pretorius (2012) was focused on direct relation between scope, time, cost and quality management and the project performance, the findings of this research revealed out that project success is functional to unique environments and contexts as indicated by competitive advantage (58.5%), complex project scope statement (85.8%), client’s demand (60.9%) and return on investment (52.5%). Correlation analysis also revealed that these four factors had significant relationships with the choice of project scope management practices employed by the organizations.

A study done by Fagehaa and Aibinu (2013) indicates that adequate front-end project planning with clear project scope definition can alleviate the potential for cost overrun, inadequate project planning and poor scope definition can lead to expensive changes, delays, rework, cost overruns, schedule overruns, and project failure. It adds that the purpose of project definition is to provide adequate information that is needed to identify the work to be performed in order to avoid major changes that may negatively affect project performance. The analysis further revealed that majority (60.9%) of the respondents agreed that client’s demand is very significant to the choice of project scope management practices, dynamism of technology (64.6%)
and returns on the investment (52.5%) are also significant to the choice of project scope management practices employed by the firms. Lastly, fast-tracking (65.6%), project delays (50.5%), client’s demand, and technical skill required (69.2%) were factors that significantly affect choice of project scope management practices employed by the organizations.

### 2.2.1 Role of determinants of project scope

Hill (2010) argues that the purpose of the change management is to ensure that no inadvertent or otherwise unauthorized changes are made to the project scope (which inherently influences some change in planned cost, schedule, or resource utilization), and that any changes that are wanted or needed will undergo a somewhat formal examination and approval process including appropriate levels of internal and customer collaboration before any changes are implemented.

Scope must be documented and reviewed by the project sponsor and stakeholders for effects. Richman (2006) argues that project scope management includes the processes and activities required to ensure that the project includes all the work required and only the work required to complete the project successfully. He added the project scope management includes scope planning, scope definition, creation of a work break down structure, scope verification, and scope control. This point is related to this study because it shows how the determinants of project scope play a crucial role on the performance of Huguka Dukore Akazi Kanoze project by determining time, cost, resources, or other aspects of the project.

### 2.2.2 The important areas in project scope

If a project’s scope during the initial phase, the effects of that will affect elements such as schedule, cost, and performance less than if the scope during the final phases. If a change request is approved, the project team must update schedules, budgets, and performance commitments (Harrington and McNellis, 2006).

Approved changes affect almost every part of a project plan. Approved changes must be incorporated into the schedule, budget, return-on-investment calculation, scope document, team charter, communications plan, deliverable list, and quality plan. All changes should be documented and analyzed for frequency modes, affected areas, organizations or departments that push change, and lessons learned. The changes should be allowed only if there’s total agreement among the sponsor and stakeholders. Once the change is approved, timelines and budgets should be updated to reflect the change (Harrington and McNellis, 2006).

Project time management also included the processes and activities needed to ensure timely completion of the project. It consists of activity definition, activity sequencing, activity resource estimating, activity duration estimating, schedule development, and schedule control (Richman, 2006). When not controlled well, the project is likely to experience challenges which may affect the project success negatively. This point is related to my study because project time management is one of the determinants of project scope.

Project cost management indicates that the project cost management knowledge area involves project costs and budgets. The activities in the project cost management area establish estimates for costs and resources and keep watch over those costs to ensure that the project stays within the approved budget. This process of project cost management involves resource planning, cost estimating, cost budgeting and cost control (Heldman, 2005).

This is done in process of project scope management with knowledge that scope change can affect work that has been already performed. This means rework costs for work that has already started or worse, been completed. When the project scope changes other components in the project cost management such as resources, budget among others will have to change also. Richman (2006) supports this idea by stating that project cost includes processes and activities that ensure the project is completed within the approved budget. It includes cost estimating, cost budgeting, and cost control. This indicates that if the scope is change, it will affect the budget. The initial budget has to be modified to the requirement of current project scope.

This point is related to my study because project cost management is one of the determinants of project scope.
Project quality management concerned with the production quality service or product, it involves the interconnection of other factors such as cost, proper usage of agreed time among others. Rose (2005), states that project quality management is linked to an overall project management in terms of processes and costs. Some project managers may be concerned that more time and cost will ship quality (Low and Ong, 2014).

The success of the project is measured from the scope aspect of a project which is inherited from quality management. Any change in project scope involves effort from the side of quality management. As Hill (2010) states, any change to the project scope almost always necessitates a controlled adjustment to project to the associated plans such as quality management among others. This point is related to my study because project quality management is one of the determinants of project scope. This means that project scope always necessitates a controlled adjustment to project to the associated plans such as quality management.

2.2.3 Project scope change control features

The change control can also include the two features like the first one is Change control responsibilities such as Specification of each team member’s responsibility to manage project scope change, including guidance for project team members to use reasonable judgment before adjusting work that could be considered “out of scope,” and related guidance for managing stakeholders requests or directions for work adjustments that could present scope issues or otherwise be contrary to the established work assignment and the second one Control authority such as Specification of who is authorized to approve changes in project scope; usually the project manager, but sometimes the project executive (sponsor) or other senior manager (or control board) retains this responsibility (Hill 2010).

2.3 Theoretical framework

Mc Cleland and McBer developed competency theory in 1980s. These authors defined competency as the underlying characteristic an individual that is usually causally related to criterion referenced effective or superior performance in a job or situation. Since then a number of authors have developed a number of competency frameworks.

Owen (2008) propounded project knowledge theory by stating that knowledge created, captured and reused within a project will result in improving project management maturity and acquaint project staff with necessary competency. According to her, project teams create, transfer and reuse knowledge created from tasks supported by knowledge management system. The framework assumes that project team will be able to conceptualize tasks, reuse and apply past knowledge and experiences supported by knowledge management system. Owen framework illustrates how knowledge is developed at task level which is then disseminated into project methodology in project implementation thus reinforcing project achievement of its deliverables. She suggests that knowledge is expressed throughout project lifecycle in tacit and explicit knowledge levels. Tacit knowledge is captured reused in the project by experienced project staffs that pass it on through coaching and mentoring. Explicit knowledge is reused in terms of project documentation during the project life cycle. This theory uses the concept of reclusiveness and extending project to program level; program is a group of projects managed together allowing added benefit control (PMI, 2013). In conclusion the author emphasizes on the need for continuous learning in projects to improve project capability by integrating knowledge management with project/program management.

2.4 Conceptual framework

The conceptual framework figure below explains the relationship between the variables under the study, determinants of Project scope (Independent Variable) and Project performance (Dependent variable).
The topic under investigation had two variables namely Determinants of Project scope (Independent Variable) and Project performance (Dependent variable). Adjusting project activities: this means if the factors of inclusion and/or exclusion are changed, there could be a need to change project activities to adjust them to new direction taken because of the scope. Managing project time means that the project has when to start and when to end; the project team has to do in way that the project activities were completed within the allocated time.

Managing project cost means that the project team has to do in way that the planned budget followed as it was agreed upon. Because the project is the temporary activities with limited budget, the team considers the project budget as it progresses. Meeting the time and budget of the project have value if the project that not produce the expected quality of outcome which satisfies the need of the beneficiaries. A project work to response to the identified need among the beneficiaries; if this does not happen, then the project cannot be considered as a performance.

3. RESEARCH METHODOLOGY
3.1 Research Design and Population
According to Jarol and Richard (2013), research design is a master plan specifies the methods and procedures for collecting and analyzing the required information. It is also a science and an art of planning procedures for conducting studies so as to get most valid findings. The study adopted survey research design using both quantitative and qualitative approaches. Quantitative approach emphasizes measurement and data is analyzed in a numerical form to give precise description. That this mode of inquiry follows...
several logical and distinct steps from identifying and stating research problem to making appropriate conclusions and inferences to
the population.
Quantitative approach places emphasis on methodology, procedure and statistical measures to test hypothesis and make predictions. The research will use quantitative approach because the data that will be collected through questionnaires from respondents will be analyzable using the standard statistical tools. Quantitative research approach includes designs, techniques and measures that produce numerical or quantifiable data. It relies on the principles of verifiability, that is confirmation, prove, or substantiation, using appropriate measurement of study variables. Qualitative approach was also adopted by the in this study because qualitative data is more in depth and provides detailed answers. It provides information about the phenomenon being studied, and established patterns, trends and relationships from the information gathered. The qualitative research provides greater depth to response and understanding which forms a link with the respondents. Qualitative research is typically rich with detail and insights into participants’ experiences of the world and thus more meaningful and the coefficient of correlation (r) was calculated to measure the effect the size and more regression was used to evaluate the influences and relationship. The target population is explained as the elements, objects and subjects that respond to the sampled population (Burns & Grove, 2011). In this study, composed by 6 managers, 24 employees of Huguka Dukore Akazi Kanoze Project and 360 beneficiaries of Huguka Dukore Akazi Kanoze Project.

3.2 Sample Design
Sample is defined as a set of individuals selected from a population, usually intended to represent the population in a research study (Gravetter and Wallnau, 2017). In this study census technique was used in getting data from different members of different sections which deal with all projects management work and project performance. Random sampling and stratified random sampling technique are defined as a complete enumeration of all items in the population (Kothari, 2016).

<table>
<thead>
<tr>
<th>Group of respondents</th>
<th>Target population</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>employees</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Beneficiaries</td>
<td>3600</td>
<td>45</td>
</tr>
<tr>
<td>Total</td>
<td>3624</td>
<td>75</td>
</tr>
</tbody>
</table>


3.3 Data Collection and Analysis

the researcher paid an informal visit to the projects while he engaged in their day-to-day activities. The field visit during this investigation has a specific aim, which was to introduce the topic and obtain the project employees’ consent. During the informal visit information on the current situation will be collected through situation analysis.

To improve the reliability of information and results, the data collection methods that were employed in the research process included research questionnaires, and interview.

An interview is a special case of social interaction between two persons or more, and as such is subject to the same rules and restrictions as other instances of social interactions. According to Kurnar (2015), interview is a common method of collecting information from individuals. It involves face-to-face interaction between the researcher and the informant (s) aims at understanding perspectives of respondents to a given issue. Interview was held with Huguka Dukore Akazi Kanoze Project staff.
In this research, questionnaires were distributed on 30 employees of Dukore Akazi Kanoze Project. The questionnaires were administered during face-to-face interviews in an attempt to avoid dominance of certain individuals in the project and to give an opportunity to the individuals to express themselves by providing the truthful responses without being intimidated by other employees.

These are the methods that the researcher used to collect both primary and secondary data from various sources and they include questionnaires and documentary review. Primary data were collected from respondents while secondary data were collected through the review of related literature from text books, journals, reports and internet. The researcher ensured that the research instruments used are reliable, consistent and free from any bias. Questionnaires and interview guide contained clear and accurate questions that intended to identify the effect of project change management on project success. These were only used for the intended purpose and the views were not be interfered with to ensure consistency. Qualitative and quantitative methods were used to analyze and interpret the data collected through questionnaires, and key-informant interviews. Both qualitative and quantitative data were subjected to standard analysis using the statistical package for social science (SPSS). Data analysis was included descriptive statistics (percentage and frequencies), cross-tabulations. Summarized data were used to determine the relationship between independent and dependent variables and to establish key comparisons by using the formula.

4. RESEARCH FINDINGS AND DISCUSSION

This chapter provides findings on the determinants of project scope and project performance. The researcher examined the empirical evidences and established the ground upon which the hypothesis was tested to be proved valid or not before the conclusion drawn. The data was analysed using the simple statistical methods, frequency tables showing responses to the particular questions were constructed and percentage despondences to the questions. The research had a simple size of 75 respondents. Therefore this research has three categories of respondents namely employees, managers and beneficiaries of Huguka Dukore Akazi Kanoze project.

4.1 Demographic characteristics of respondents

Demographically, any organized population may be characterized by the following: gender, age, educational level and experience of working in the project. The researcher to make a description of respondents in scientific research has used the demographic characteristics and this helped the researcher to categorise them, the researcher assess the demographic characteristics to known the quality of respondents if they are experienced to the projects performance, if they are quailed for projects implementation and their management, if the all gender were included in the huguka dukore akazi kanoze project.

4.1.1 Gender distribution of respondents

Gender is one of main factor of human resource productivity. Consequently, this research targeted to know the sex structure of respondents in order to assess the role played by the respondents accordingly. Then, the following table indicates gender distribution of respondents.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>41</td>
<td>54.7</td>
</tr>
<tr>
<td>Male</td>
<td>34</td>
<td>45.3</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020
From the table 2, it is noted that 54.7% of respondents are females while males took the percentage of 45.3% of total respondents. These findings would be explained that political ideology of Rwanda priory’s women to participate in all sectors of economy, this also observed in Huguka Dukore Akazi Kanoze project.

4.1.2 Age distribution of respondents

Age is one of main factor of human resource productivity. Consequently, this research targeted to know the age structure of respondents in order to assess the role played by the respondents accordingly. Then, the following table indicates age distribution of respondents. As shown the table 3 the largest number of respondents falls into age group of 31-40 years that makes up the percentage of 42.7% of respondents. This percentage shows that the majority of our respondents are energetic people to participate in productive activities within the community. It is followed by 29.3% of respondents lying in the age group of 20-30 years and the age group of 41-50 years that 26.7% of respondents finally 1.3% of total respondents are in range of age group of 51 years and above.

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30 years</td>
<td>22</td>
<td>29.3</td>
</tr>
<tr>
<td>31-40 years</td>
<td>32</td>
<td>42.7</td>
</tr>
<tr>
<td>41-50 years</td>
<td>20</td>
<td>26.7</td>
</tr>
<tr>
<td>51 years and Above</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

4.1.3 Highest academic level

To comply with duties and responsibilities of any job description, educational level is one of major criteria. Then, the following table indicates the highest educational level of surveyed respondents.

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary</td>
<td>15</td>
<td>20.0</td>
</tr>
<tr>
<td>Diploma</td>
<td>20</td>
<td>26.7</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>20</td>
<td>26.7</td>
</tr>
<tr>
<td>Master’s degree and above</td>
<td>20</td>
<td>26.7</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: primary data, 2020

As shown in the table 4, 20.0% of respondents said that they have secondary level, 26.7% of respondents said that they have diploma, again 26.7% of respondents have Bachelor’s degree, finally 26.7% of respondents have Master’s degree and above means that all respondent were qualified to participate in the projects to achieve its objectives.

4.1.4 The length of years that respondents working with HDAK project.

The following table illustrates the length of years that respondents work with this project.
Table 5 The length of years that respondents working with Huguka Dukore Akazi Kanoze project.

<table>
<thead>
<tr>
<th>Number of years</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 1 year</td>
<td>30</td>
<td>40.0</td>
</tr>
<tr>
<td>Between 1- 3 years</td>
<td>20</td>
<td>26.7</td>
</tr>
<tr>
<td>Above 3 years</td>
<td>25</td>
<td>33.3</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The table 5 shows the responses of the length of years that respondents working with this project. Then 40.0% of respondents said that they working with Huguka Dukore Akazi Kanoze project in the period of less than one year, again 26.7% of respondents said that they working with Huguka Dukore Akazi Kanoze project in the period of between 1 and 3 years finally 33.3% of respondents said that they working with Huguka Dukore Akazi Kanoze project in the period of in the period of 3 years and above those percentages indicated that most of respondent were experienced to meet all requirement to achieve the purpose of the projects.

4.2 Presentation of findings

4.2.1. The Resources available which affect project productivity

During the research, the researcher wanted to know the kinds of resources available in Huguka Dukore Akazi Kanoze project. And the details are shown in the table 6

Table 6 The kinds of resources available in Huguka Dukore Akazi Kanoze project

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural or physical resources</td>
<td>45</td>
<td>60.0</td>
<td>30</td>
<td>40.0</td>
</tr>
<tr>
<td>Financial resources</td>
<td>45</td>
<td>60.0</td>
<td>30</td>
<td>40.0</td>
</tr>
<tr>
<td>Human resources</td>
<td>45</td>
<td>60.0</td>
<td>30</td>
<td>40.0</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020.

The table 6 indicates that 60.0% of respondents and 40.0% of respondents strongly agreed and agreed respectively that the first kind of resources in Huguka Dukore Akazi kanoze is natural or physical resources means that the projects have potentials physical natural resources to perform the project activities, also research want to know the if the projects has resourced financially therefore the findings indicated that 60.0% of respondents strongly agreed that the second kind of resources in Huguka Dukore Akazi kanoze is financial resources and the 40% of respondent raised that they agreed that the projects have financial support finally 60.0% of respondents agreed that other kind of resources in Huguka Dukore Akazi kanoze is human resources. Richman (2006) supports this idea by stating that project cost includes processes and activities that ensure the project is completed within the approved budget. It includes cost estimating, cost budgeting, and cost control. This indicates that if the scope is change, it will affect the budget. The initial budget has to be modified to the requirement of current project scope. This point is related to my study because project cost management is one of the determinants of project scope.

4.2.2 The effect of schedule on the needs of stakeholders of HDAK Project

the researcher wanted to know the affect of time/schedule on the needs of stakeholders of Huguka Dukore Akazi Kanoze Project. And the details are shown in the table 7
Table 7 The effect of schedule on the needs of stakeholders of Huguka Dukore Akazi Kanoze Project

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time helps in setting goals of the project</td>
<td>15</td>
<td>60</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>It identifies clear path of the project</td>
<td>15</td>
<td>60</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Time helps in prioritizing for a better performance</td>
<td>15</td>
<td>60</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>It shows chronological order of project activities</td>
<td>15</td>
<td>60</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Source:** Primary data, 2020

The findings indicated in the table 7 of this study displays the responses about the effect of time/schedule on the needs of stakeholders of Huguka Dukore Akazi Kanoze Project, the results from respondents were shown that the majority 80.0% of respondents agreed that time helps in setting goals of the project and 20% of respondents were strongly appreciated the time facilitate in planning of projects goals means during planning process, any projects should consider mainly the time in goals setting in organization. The findings also were based on how schedule also participate in the identification of the clear path of performance within the projects therefore the results indicated that of the majority 80.0% of respondents agreed that time/schedule identifies clear path for performance in the project and 20% of participants shown that they need more time to identify good way toward projects performance.

Other statement asked to the respondent to show their views were focused on how the time facilitate in the tasks prioritization for a better performance in the projects and the findings were shown in the table 7 where the majority 80.0% of respondents agreed that time/schedule helps in prioritizing for a better performance of Huguka Dukore Akazi Kanoze project and 20% of respondents were strongly accepted that time is needed to enhance projects performance, the last statement based on the time use were how It shows chronological order of project activities and the results were that 80.0% of respondents agreed that shows chronological order of Huguka Dukore Akazi Kanoze project activities and 20.0% of respondents were strongly indicated that time is needed in the provision of chronological order of the projects within an organization therefore time/schedule is considered as main determinant of projects scope to dress the projects performance.

4.2.3 Budget on the performance and quality in HDAK project

Researcher wanted to know the influence of budget and cost on the performance and quality in Huguka Dukore Akazi Kanoze project and the details are shown in the table 8 The findings indicated in the table 8 of this study displays the responses about the influence of budget and cost on the performance and quality in Huguka Dukore Akazi Kanoze project therefore the results were summarized with the statement and the results shown that the majority 64.0% of respondents appreciated that budget and cost helps to achieve the desired outcomes of the project and the 36% of respondents were strongly agreed that the cost and budget are needed in the projects performance. The second statement was based on how budget and cost helps to meet the need of stakeholders of the project and the results were 69.3% of respondents agreed budget and cost facilitate to meet the need of stakeholders and the 30.7% of respondents were strongly agreed that cost and budget promote the stakeholders involvement in projects activities.
Table 8 the influence of budget and cost on the performance and quality in Huguka Dukore Akazi Kanoze project

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget and cost help to achieve the desired outcomes of the project</td>
<td>27</td>
<td>36.0</td>
<td>48</td>
</tr>
<tr>
<td>Budget and cost helps to meet the need of stakeholders of the project</td>
<td>23</td>
<td>30.7</td>
<td>52</td>
</tr>
<tr>
<td>Budget and cost helps to achieve on the expected quality of the project</td>
<td>15</td>
<td>20.0</td>
<td>60</td>
</tr>
<tr>
<td>Budget help in estimation of material costs</td>
<td>30</td>
<td>40.0</td>
<td>45</td>
</tr>
</tbody>
</table>

Source: Primary data, 2020

The third statement were focused on how Budget and cost helps to achieve on the expected quality of the project and the majority 80.0% of respondents strongly agreed budget and cost help to achieve on the expected quality of the project while 20% of respondents were agreed that Budget and cost helps to achieve on the expected quality of the project means that the budget and cost are required to meet the projects performance in organization.

Last statement on the budget were based on how budget help in estimation of material costs and the results were 60.0% of respondents agreed Budget help in estimation of material costs and the 40% of respondent were strongly agreed how the Budget help in estimation of material costs therefore the projects activities were based on the budget and cost in organization.

4.2.4 The relationship between of determinants of project scope and project performance

The relationship between brand strategies and consumer preferences was statistically tested using Pearson’s correlation matrix. This was used because both the brand strategies and consumer preferences were numerical. The results obtained are shown in table 9.

Table 9 Statistical test using Pearson’s correlation matrix

<table>
<thead>
<tr>
<th></th>
<th>Productivity</th>
<th>Stakeholders satisfaction</th>
<th>Cost performance and quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Available resources</strong></td>
<td>Pearson Correlation</td>
<td>.932**</td>
<td>.680**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.001</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td><strong>Time/schedule</strong></td>
<td>Pearson Correlation</td>
<td>.684**</td>
<td>.789**</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
</tr>
</tbody>
</table>
The findings indicated in the table 9 shown that there is a correlation between the productivity with the use of available resources where the results revealed that they is a very high positive correlation with the Pearson correlation coefficient(r) of 0.932 which was produced with p-value of 000 of 2-tailed means that with available resources, the projects can make more productivity which shown strong positive and statistically significant for available resources and productivity.

The findings also shown that there is a correlation between available resources and stakeholder stratification and it is indicated by the retrieved the Pearson correlation coefficient (r) of 0.680 which was produced with p-value of 000 of 2-tailed means that there is a need of available resources to attract the stakeholder satisfaction, this coefficients indicate a weak positive correlation means that to motivate different stakeholders satisfaction in a project require the available resources to meet project objectives.

Finding in table 9 indicated that Available resources and Cost performance and quality were correlative with the success of project. The correlation coefficients are shown in table 9, r=0.707 is accordingly and was produced with p-value of 000 of a 2-tailed. The findings show strong positive and statistically significant mean that cost performance and quality require the available resources.

Finding in table 9 indicated that Time/schedule and Productivity were correlative with the success of project. The correlation coefficients are shown in table 9 r=0.684 is accordingly and was produced with p-value of 000 of a 2-tailed. The findings show strong positive and statistically significant mean that Productivity requires the sufficient time and period performing projects objective.

Finding in table 9 indicated that Time/schedule and Stakeholders satisfaction were correlative with the success of project. The correlation coefficients are shown in table 9 r=0.789 is accordingly and was produced with p-value of 000 of a 2-tailed. The findings show strong positive and statistically significant mean those Stakeholders satisfaction requires the sufficient time and period to perform projects objective.

Finding in table 9 indicated that Time/schedule and Cost performance and quality were correlative with the success of project. The correlation coefficients are shown in table 9 r=0.725 is accordingly and was produced with p-value of 000 of a 2-tailed. The findings show strong positive and statistically significant mean Cost performance and quality requires the sufficient time and period to perform projects objective.

The findings indicated in the table 9 shown that there is a correlation between the productivity with the Budget/ cost where the results revealed that they is a very high positive correlation with the Pearson correlation coefficient(r) of 0.845 which was produced with p-value of 000 of 2-tailed means that with Budget/ cost, the projects can make more productivity which shown strong positive and statistically significant for Budget/ cost and productivity.

The findings indicated in the table 9 shown that there is a correlation between the Stakeholders satisfaction with the Budget/ cost where the results revealed that they is a very high positive correlation with the Pearson correlation coefficient(r) of 0.874 which was produced with p-value of 000 of 2-tailed means that with Budget/ cost, the projects can make more productivity which shown strong positive and statistically significant for Budget/ cost and Stakeholders satisfaction.

The findings indicated in the table 9 shown that there is a correlation between the Cost performance and quality with the Budget/ cost where the results revealed that they is a very high positive correlation with the Pearson correlation coefficient(r) of 0.751 which was...
produced with p-value of 0.000 of 2-tailed means that with Budget/ cost, the projects can make more Cost performance and quality which shown strong positive and statistically significant for Budget/ cost and Cost performance and quality.

Table 9 indicates a correlation matrix between determinants of project scope (available resources, time/schedule, budget/cost) and project performance (Productivity, stakeholders satisfaction, cost performance and quality).

Furthermore, our findings show that there is the relationship between of determinants of project scope and project performance because determinants of project scope (available resources, time and need of stakeholders) helps to achieve the desired outcomes, help to meet the need of stakeholders, to achieve on the expected quality, help to deliver the expected project goals and they help estimate material costs of the project help to carry out the project tasks, help to carry out the project tasks used to announce the project location, used to announce to meet up the project beneficiaries, help to manage other resources of the project.

4.2.5 Regression between Determinants of project scope and project performance

This research carried out a regression analysis determinants of project scope and Project performance. The table 10 show a regression analysis, through a summary of model, analysis of variance and regression coefficients.

This Table 10 provides a model summary between the indicators of independent variable and productivity/outcomes.

Table 10 Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.925*</td>
<td>.855</td>
<td>.854</td>
<td>.41684</td>
</tr>
</tbody>
</table>

a. Independent variable: Constant (Available resources, Time/schedule, Budget/ cost)

b. Dependent variable: Productivity/outcomes

From Table 10, the value of Adjusted R Square was 0.855. This means that there was a variation of 85.5% on productivity/outcomes due to changes in the independent variable (Available resources, Time/schedule, Budget/ cost).

Table 11 Regression Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>Std. Error</th>
<th>Beta</th>
<th>T</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Beta</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 (Constant)</td>
<td>.568</td>
<td>.911</td>
<td>.052</td>
<td></td>
<td>11.006</td>
<td>.000</td>
</tr>
<tr>
<td>Available resources</td>
<td>.067</td>
<td>.091</td>
<td>.021</td>
<td>.091</td>
<td>3.124</td>
<td>.002</td>
</tr>
<tr>
<td>Time/schedule</td>
<td>.139</td>
<td>.192</td>
<td>.023</td>
<td>.192</td>
<td>6.163</td>
<td>.000</td>
</tr>
<tr>
<td>Budget/cost</td>
<td>.240</td>
<td>.365</td>
<td>.034</td>
<td>.365</td>
<td>7.118</td>
<td>.000</td>
</tr>
</tbody>
</table>

a. Independent variables: Constant (Available resources, Time/schedule, Budget/ cost)

b. Dependent variable: Productivity/outcomes

The finding revealed that holding independent variables (Available resources, Time/schedule, Budget/ cost) to a constant zero, Productivity/outcomes gained by Akazi Kanoze project would between 13.9 and 67%, a unit improves in Available resources to increase in Productivity/outcomes limited by a factor of .051, a unit increase in Time/schedule leads to increase in
Productivity/outcomes limited by a factor of .021, finally, a unit increase in Budget/ cost leads to increase in productivity/outcomes limited by a factor of .034.

5. CONCLUSION AND RECOMMENDATIONS

5.2 Conclusion

The study sought to establish the relationship between determinants and project performance by Huguka Dukore Akazi Kanoze project. On the basis of the findings, the researcher arrived at several conclusions. Regarding the first objective, the study found that find out available resources affect productivity or outcomes of Huguka Dukore Akazi Kanoze project; Similarly, based on the second objective, the study revealed that time/schedule effect on meeting the needs of stakeholders of Huguka Dukore Akazi Kanoze project; and based on the third objective, the study revealed that budget and cost influence the performance and quality in Huguka Dukore Akazi Kanoze project; The forth objective, which sought to analyze the relationship between determinants of project scope and project performance in Huguka Dukore Akazi Kanoze project; the study revealed that A strong positive relationship (r=.806*) was established because .806 is close to 1, implying that a positive relationship that was significant at 0.01 level existed between the determinants of project scope and project performance. Furthermore, our findings show that there is the relationship between of determinants of project scope and project performance because determinants of project scope (available resources, time and need of stakeholders) helps to achieve the desired outcomes, help to meet the need of stakeholders, to achieve on the expected quality, help to deliver the expected project goals and they help estimate material costs of the project help to carry out the project tasks, help to carry out the project tasks used to announce the project location, used to announce to meet up the project beneficiaries, help to manage other resources of the project.

5.2 Recommendations

Basing on the conclusion made above, the researcher has embarked himself on determinants of the project scope and project performance and the results revealed a number of areas aimed at improvement of both agriculture-based cooperatives and livelihood of farmers in Rwanda. It is recommended to the project to involve beneficiaries in the definition of project scope would help to understand more their expectation to avoid changing the scope based on this condition. Considering donor(s) requirements is another point to put in mind when carrying out the process of project change. To verify the initial scope before staring the implementation to find out if it is suitable for the environment. To communicate to the project team as soon as they find that the project activities are taking direction that will not help in solving the problem they have before intervention of the project. Beneficiaries have to ensure their participation to be able to known if the project is taking the right direction to satisfy their need. The study recommends that the government creates policies on project implementation which will flows to the final satisfaction of customers in regards to projects performance. The project should be allotted sufficient period of time in order to avoid losses during the sudden changes. It suggests that the Government should take measures to use online procurement in all governmental tendering processes to enhance the project implementation. It recommends that the policy makers enhance the awareness of contractors’ implementation strategies for successful delivery of projects implementation; awareness of the community to involve in projects implementation for the success of the implementation; government to support projects implementation both during implementation and beyond.

REFERENCES


Fageha & Aibinu. (2013). Scope definition for expanding operating projects. AACE.


